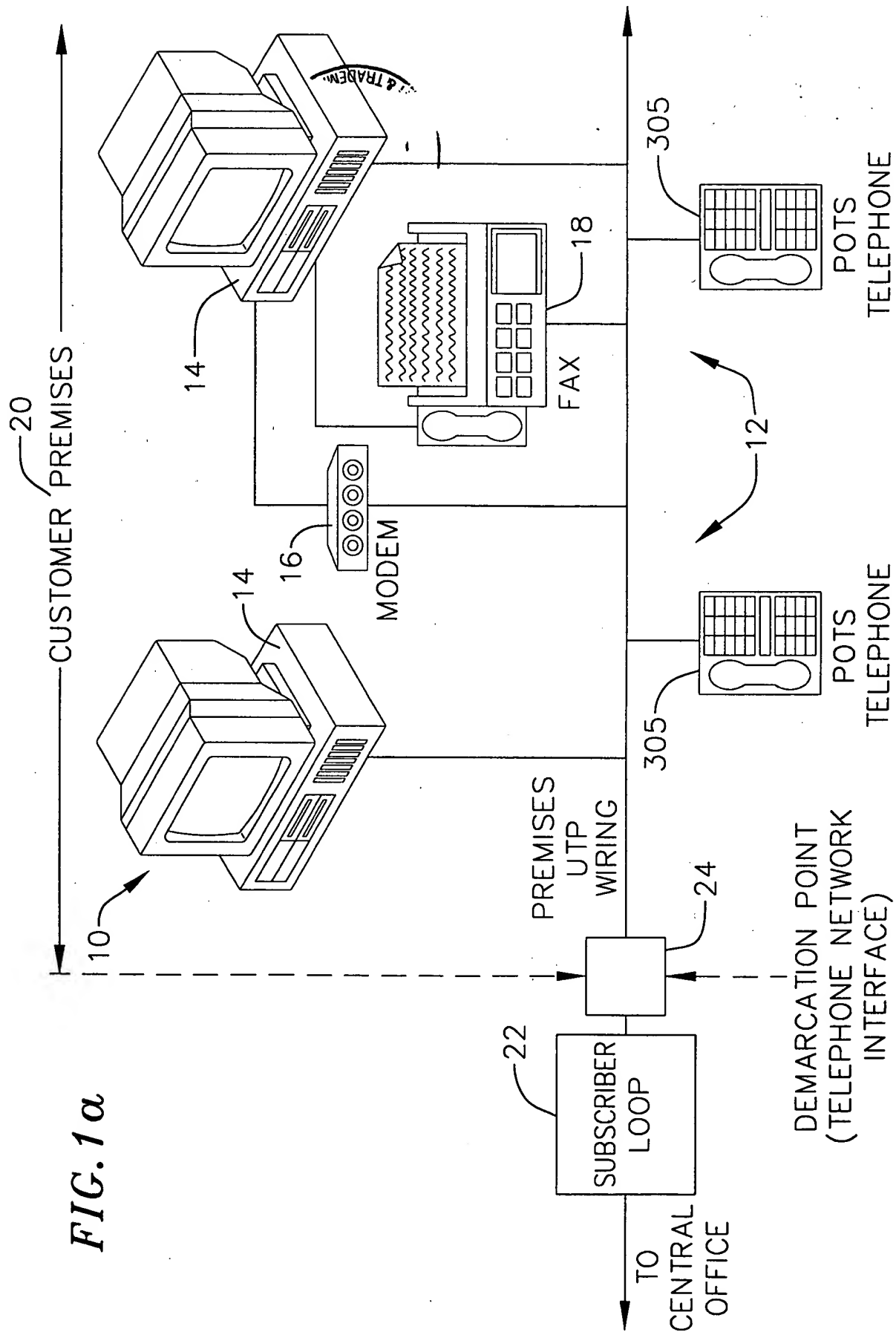


FIG. 1a



104040, 1505050, 09025051, 040401

FIG. 1b

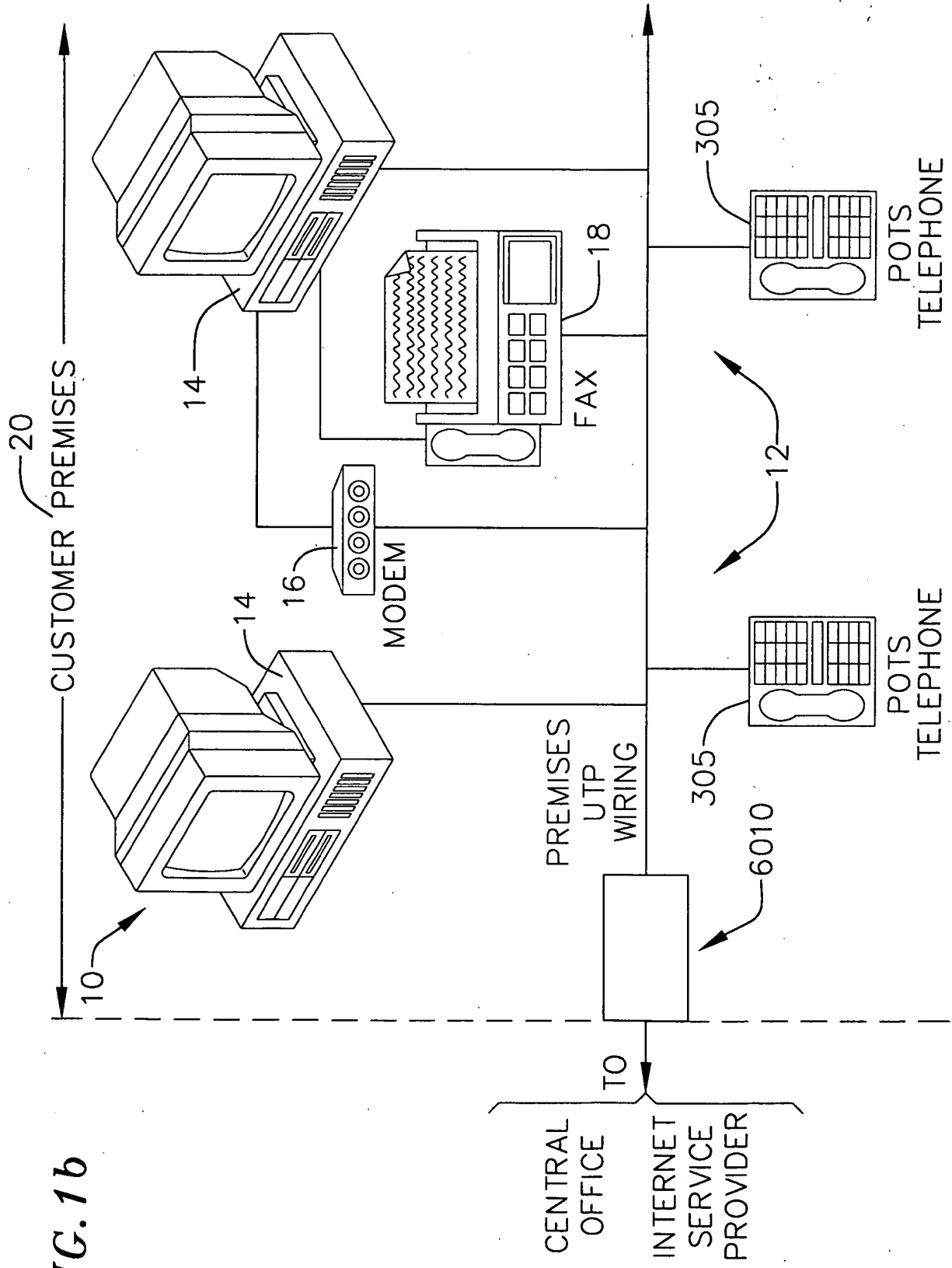


FIG. 1c

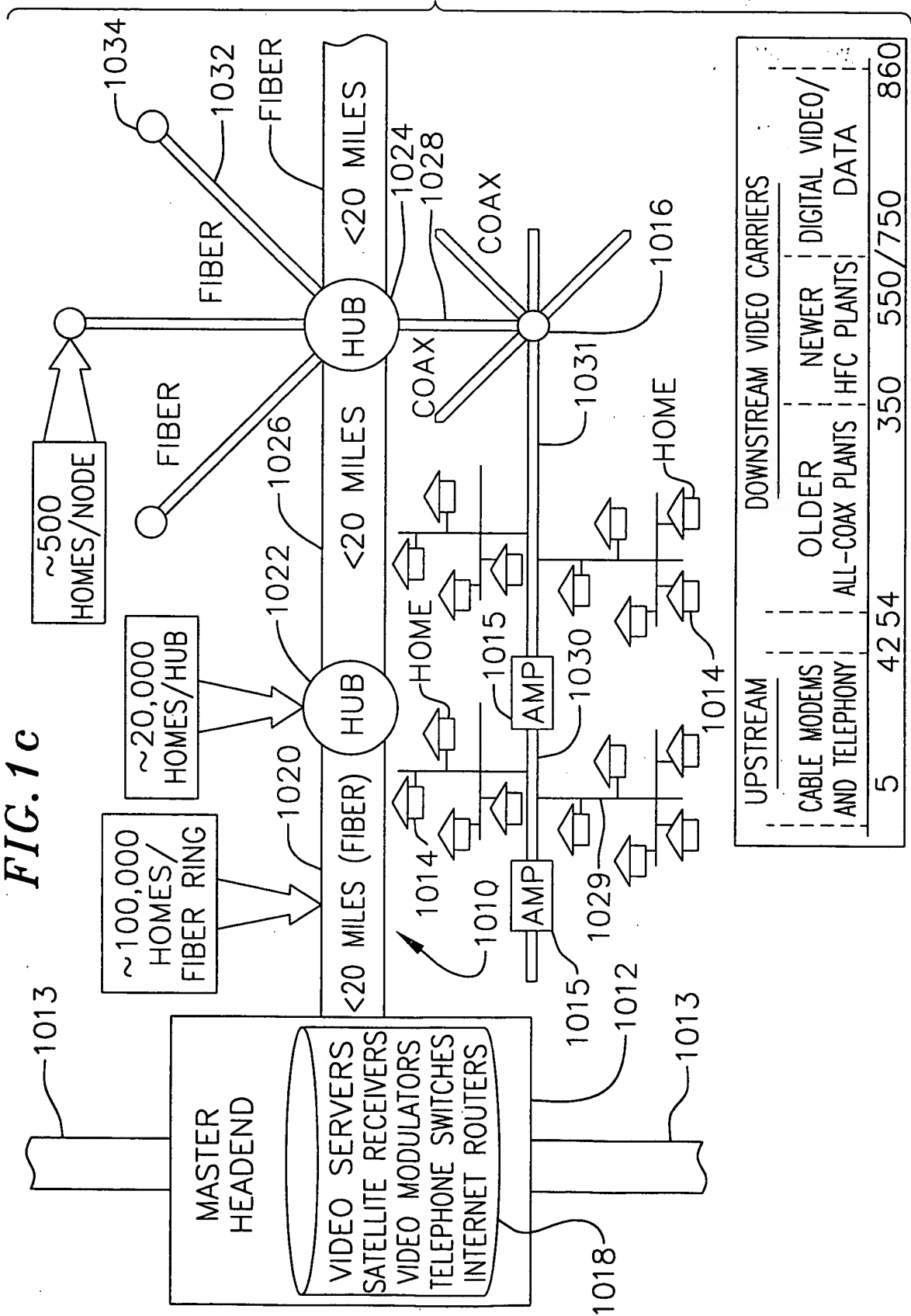


FIG. 1d

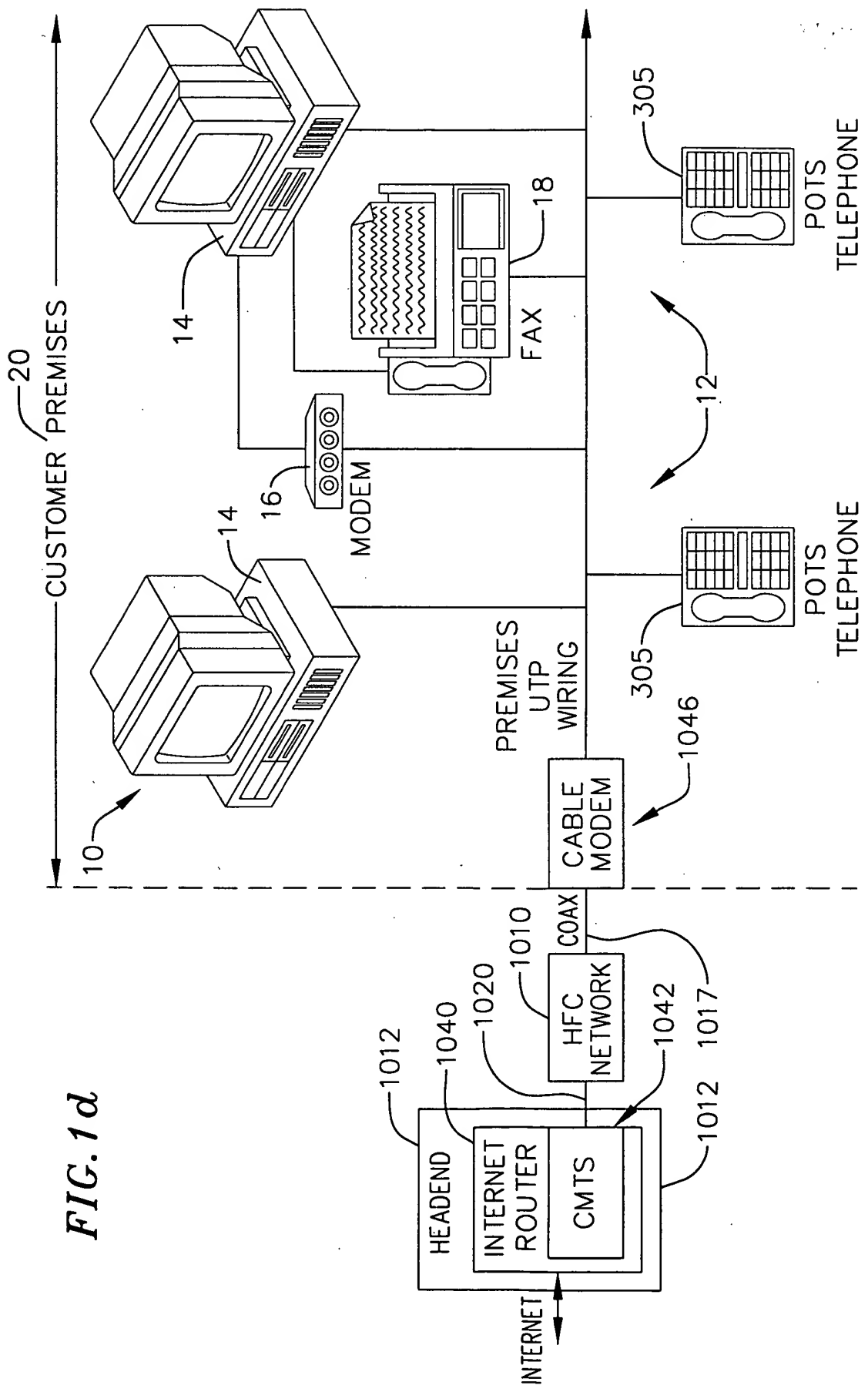


FIG. 2

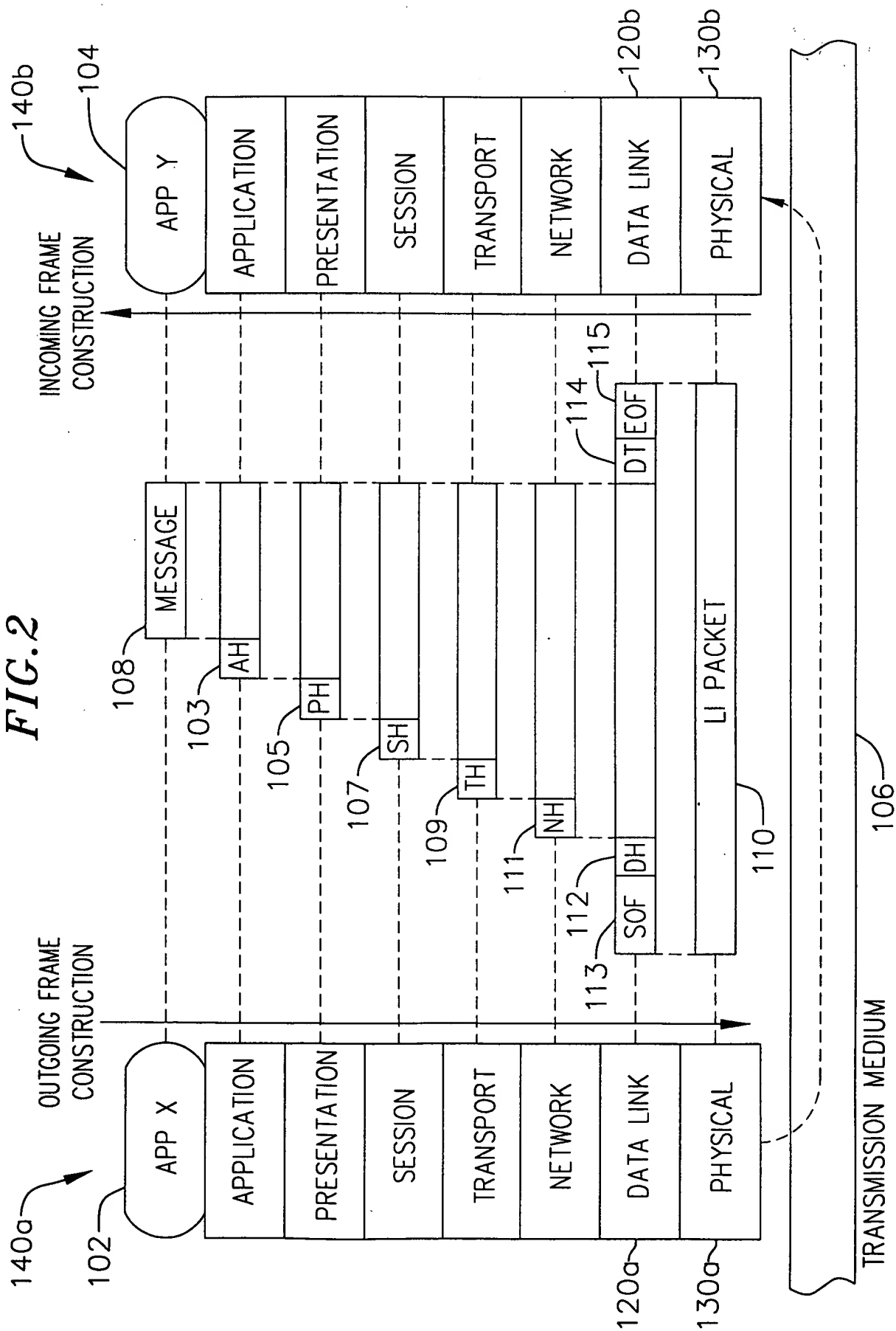


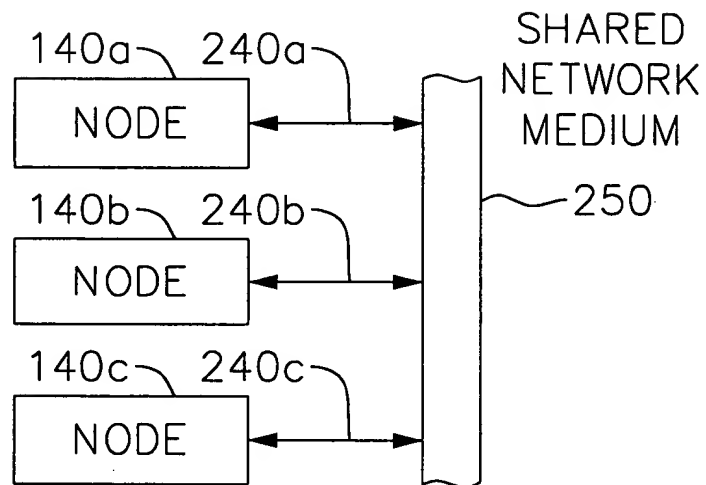
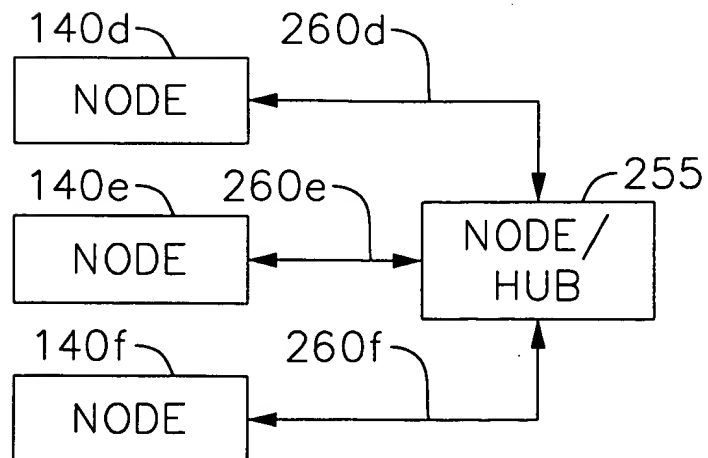
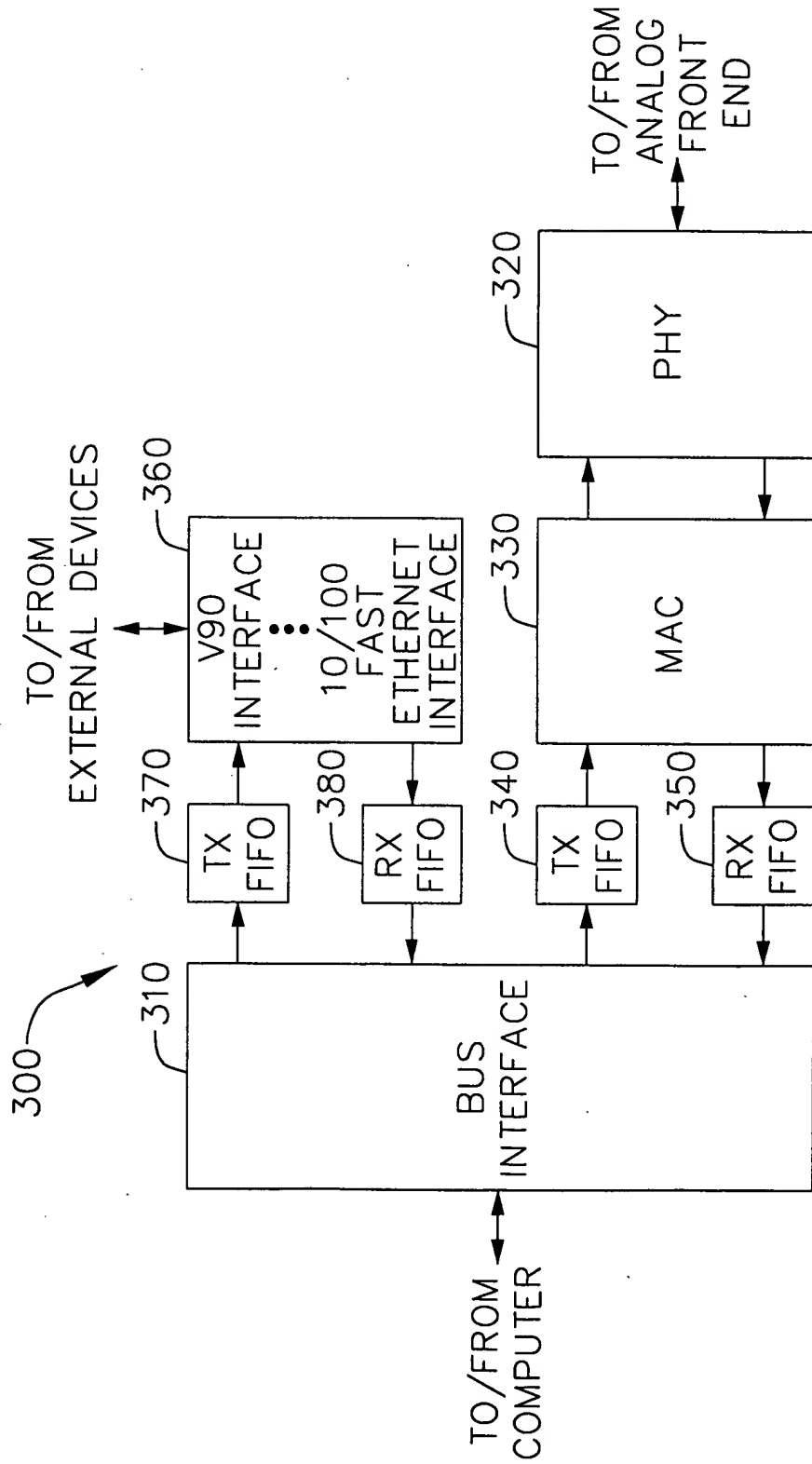
FIG. 3a*FIG. 3b*

FIG. 4a



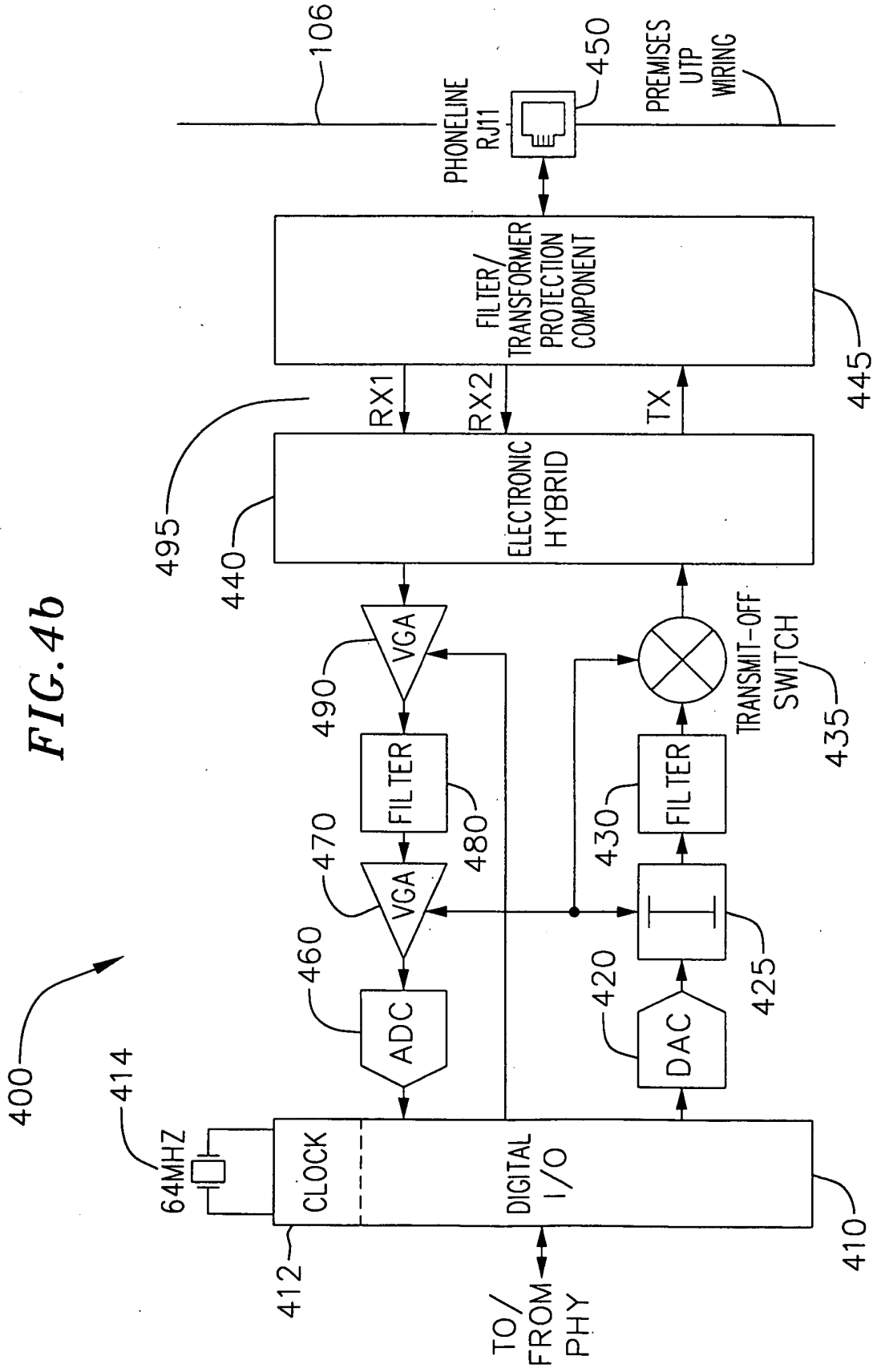


FIG. 5

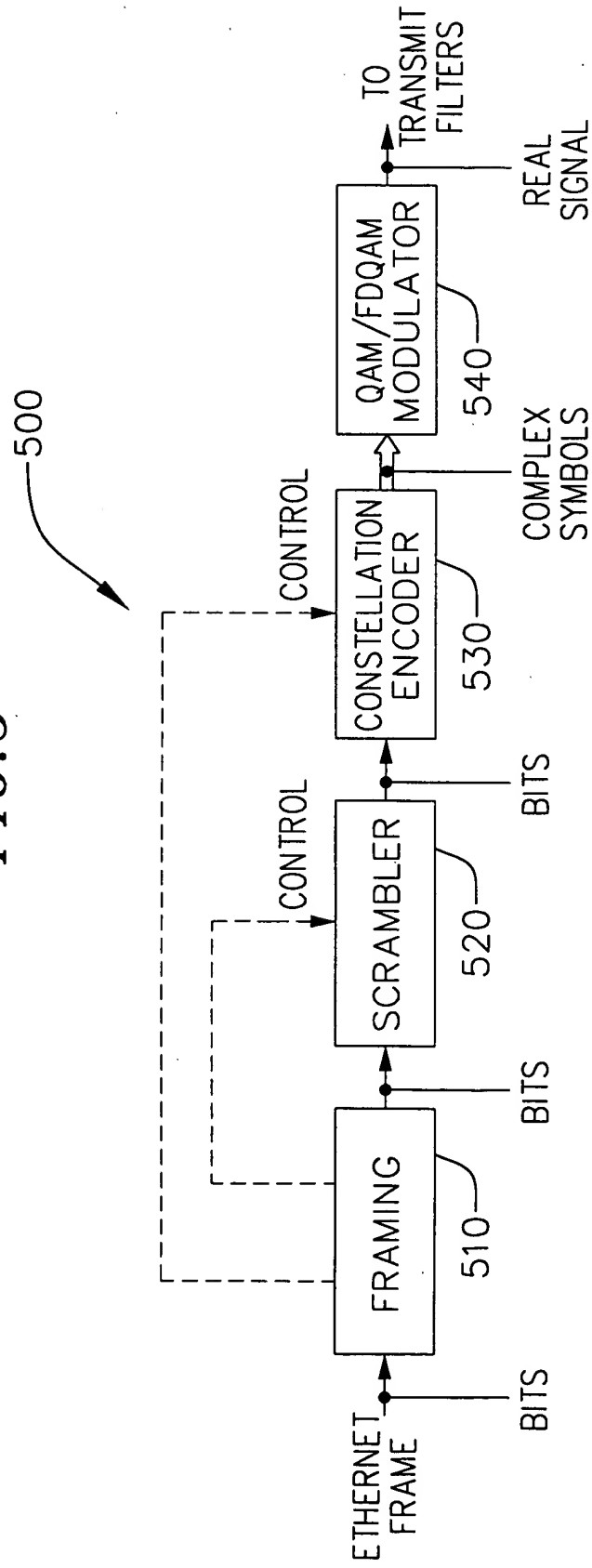


FIG. 6

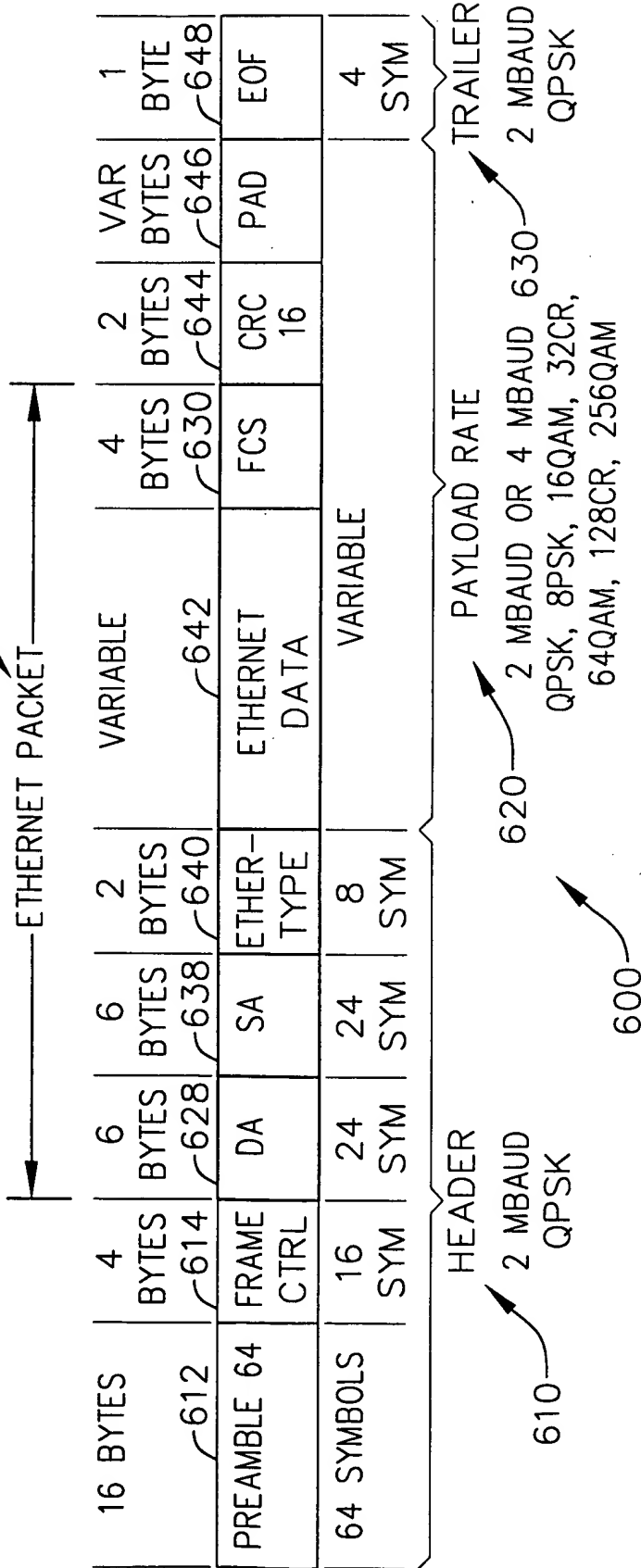


FIG. 8

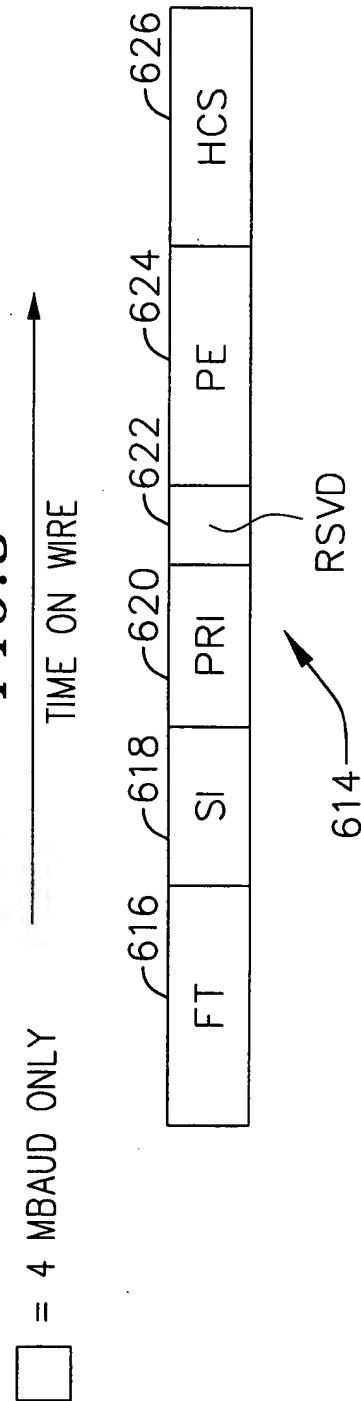


FIG. 7

FIELD	BIT NUMBER	BITS	DESCRIPTION
FT	31:24	8	FRAME TYPE. THIS FIELD SHALL BE SET TO ZERO BY THE TRANSMITTER. THE RECEIVER SHALL DECODE THIS FIELD AND DISCARD THE FRAME IF IT'S ANYTHING OTHER THAN ZERO.
RSVD	23	1	RESERVED. THIS FIELD SHALL BE SET TO ZERO BY THE TRANSMITTER, AND THE RECEIVER SHALL IGNORE IT.
PRI	22:20	3	PRIORITY (0-7)
SI	19:16	4	SCRAMBLER INITIALIZATION
PE	15:8	8	PAYLOAD ENCODING
HCS	7:0	8	HEADER CHECK SEQUENCE

FIG. 11

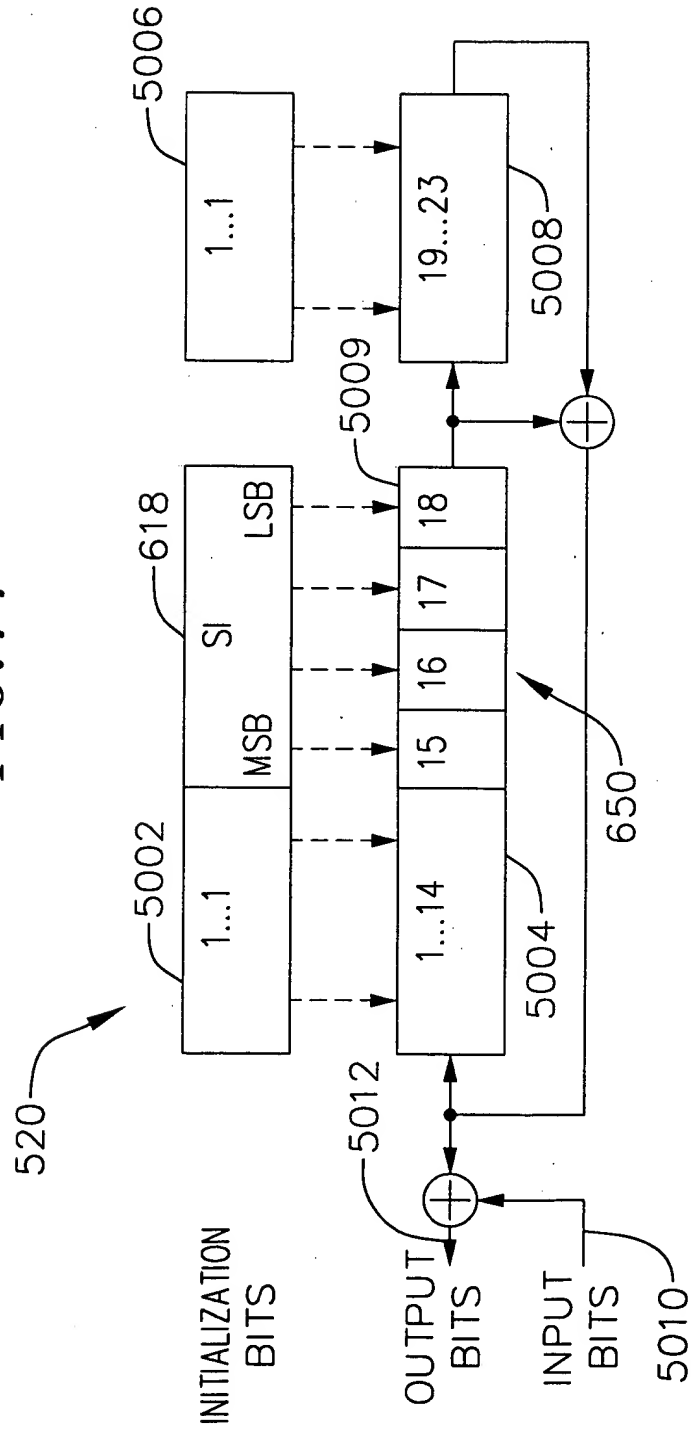


FIG. 12a
2 BITS PER BAUD

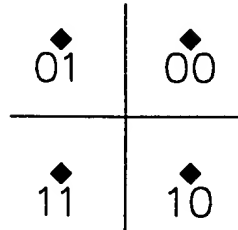


FIG. 12b
3 BITS PER BAUD

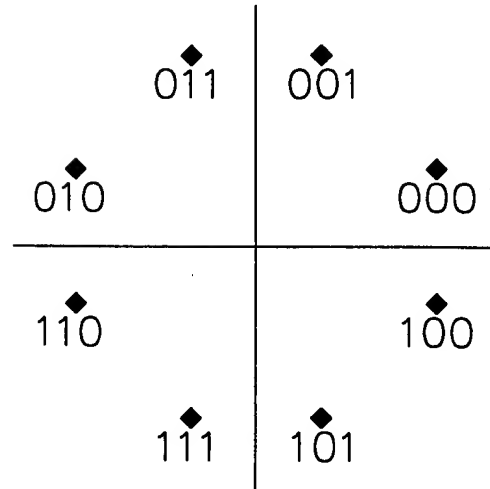


FIG. 12c
4 BITS PER BAUD

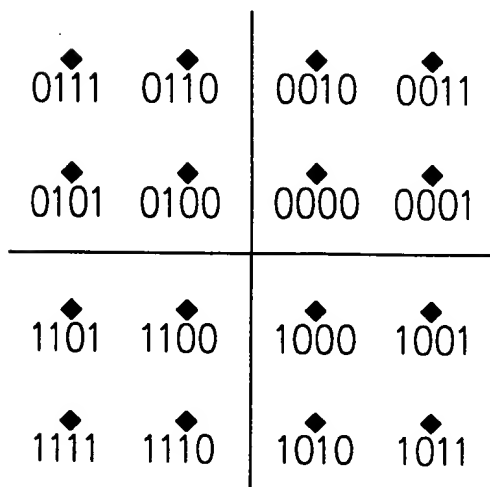


FIG. 12d
5 BITS PER BAUD

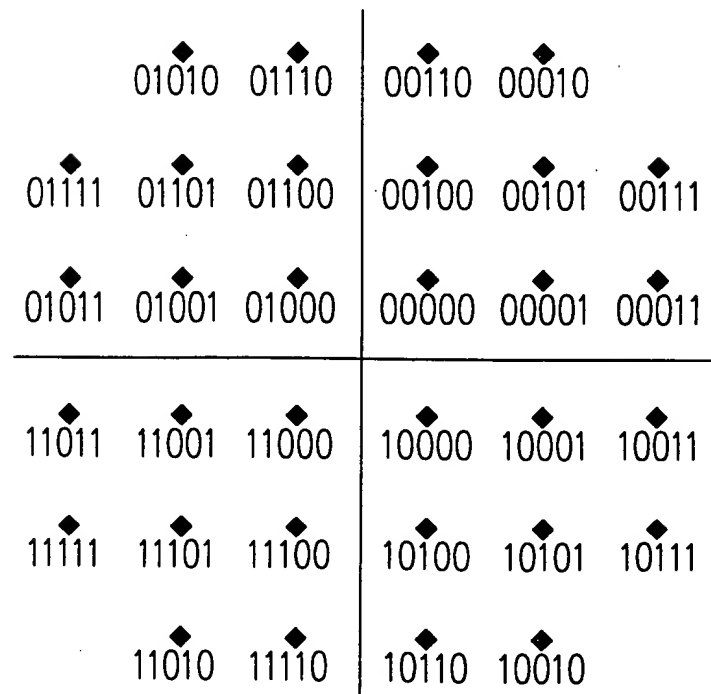


FIG. 12e

6 BITS PER BAUD

011010	011011	011001	011000	001000	001001	001011	001010
011110	011111	011101	011100	001100	001101	001111	001110
010110	010111	010101	010100	000100	000101	000111	000110
010010	010011	010001	010000	000000	000001	000011	000010
110010	110011	110001	110000	100000	100001	100011	100010
110110	110111	110101	110100	100100	100101	100111	100110
111110	111111	111101	111100	101100	101101	101111	101110
111010	111011	111001	111000	101000	101001	101011	101010

FIG. 12f

7 BITS PER BAUD

0101100	0101101	0111101	0111100	0011100	0011101	0001101	0001100
0100100	0100101	0110101	0110100	0010100	0010101	0000101	0000100
0110111	0110110	0110011	0110001	0010000	0010001	0010011	0010010
0111111	0111110	0111011	0111001	0011000	0011001	0011011	0011010
0101111	0101110	0101011	0101001	0001000	0001001	0001011	0001010
0100111	0100110	0100011	0100001	0000000	0000001	0000011	0000010
1100111	1100110	1100011	1100001	1000000	1000001	1000011	1000010
1101111	1101110	1101011	1101001	1001000	1001001	1001011	1001010
1111111	1111110	1111011	1111001	1011000	1011001	1011011	1011010
1110111	1110110	1110011	1110001	1010000	1010001	1010011	1010010
1100100	1100101	1110101	1110100	1010100	1010101	1000101	1000100
1101100	1101101	1111101	1111100	1011100	1011101	1001101	1001100

09825851 .040401

FIG. 12g

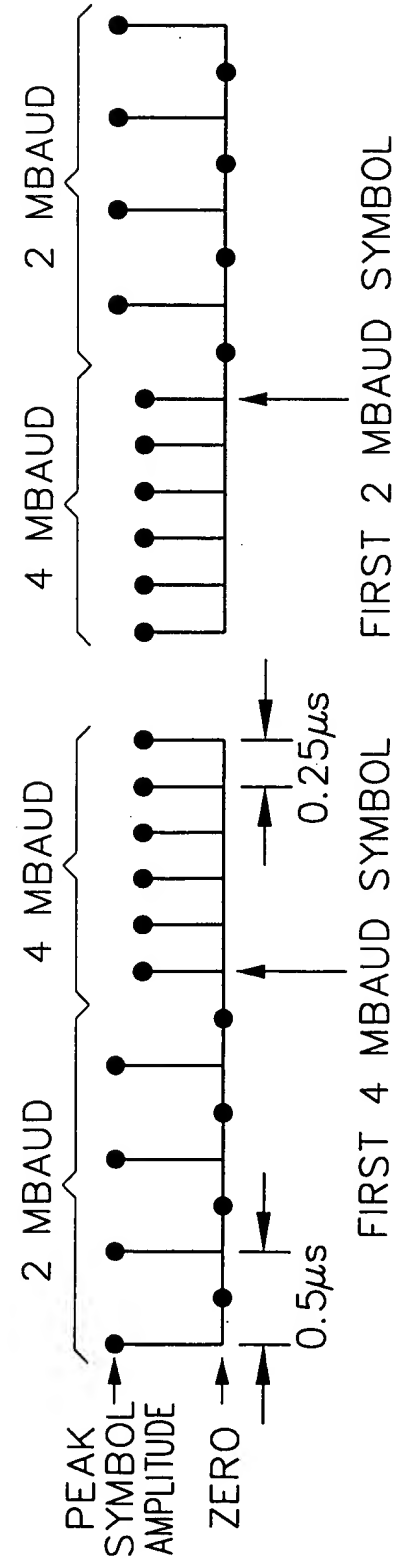
8 BITS PER BAUD

01100100	01100101	01100111	01100110	01100010	01100011	01100001	01100000	00100000	00100001	00100011	00100010	00100110	00100111	00100101	00100100
01101100	01101101	01101111	01101110	01101010	01101011	01101001	01101000	00101000	00101001	00101011	00101010	00101110	00101111	00101101	00101100
01110100	01110101	01110111	01110110	01110101	01110101	01110100	01110100	00110100	00110101	00110111	00110110	00111110	00111111	00111101	00111100
01110100	01110101	01110111	01110110	01110101	01110101	01110100	01110100	00110000	00110001	00110011	00110010	00110110	00110111	00110101	00110100
01010100	01010101	01010111	01010110	01010101	01010101	01010100	01010100	00010100	00010101	00010111	00010110	00010110	00010111	00010101	00010100
01011100	01011101	01011111	01011110	01011101	01011101	01011100	01011100	00011100	00011101	00011111	00011110	00011110	00011111	00011101	00011100
01001100	01001101	01001111	01001110	01001101	01001101	01001100	01001100	00001100	00001101	00001111	00001110	00001110	00001111	00001101	00001100
01000100	01000101	01000110	01000110	01000010	01000011	01000001	01000000	00000000	00000001	00000011	00000010	00000110	00000111	00001101	00000100
11000100	11000101	11000111	11000110	11000010	11000011	11000001	11000000	10000000	10000001	10000011	10000010	10000110	10000111	100000101	100000100
11001100	11001101	11001111	11001110	11001010	11001011	11001001	11001000	10001000	10001001	10001011	10001010	10001110	10001111	10001101	10001100
11011100	11011101	11011111	11011110	11011010	11011011	11011001	11011000	10011000	10011001	10011011	10011010	10011110	10011111	10011101	10011100
11010100	11010101	11010111	11010110	11010010	11010011	11010001	11010000	10010000	10010001	10010011	10010010	10010110	10010111	10010101	10010100
11110100	11110101	11110111	11110110	11110010	11110011	11110001	11110000	10110000	10110001	10110011	10110010	10110110	10110111	10110101	10110100
11111100	11111101	11111111	11111110	11111010	11111011	11111001	11111000	10111000	10111001	10111011	10111010	10111110	10111111	10111101	10111100
11101100	11101101	11101111	11101110	11101010	11101011	11101001	11101000	10101000	10101001	10101011	10101010	10101110	10101111	10101101	10101100
11100100	11100101	11100111	11100110	11100010	11100011	11100001	11100000	10100000	10100001	10100011	10100010	10100110	10100111	10100101	10100100

FIG. 13

BITS PER BAUD	REFERENCE POINT(S)	VALUE
2	00	$1+i$
3	000 001	$(12+5i)/9$ $(5+12i)/9$
4	0000	$(1+i)/3$
5	00000	$(1+i)/4$
6	000000	$(1+i)/7$
7	0000000	$(1+i)/9$
8	00000000	$(1+i)/15$

FIG. 14



09025851 040401

FIG. 15

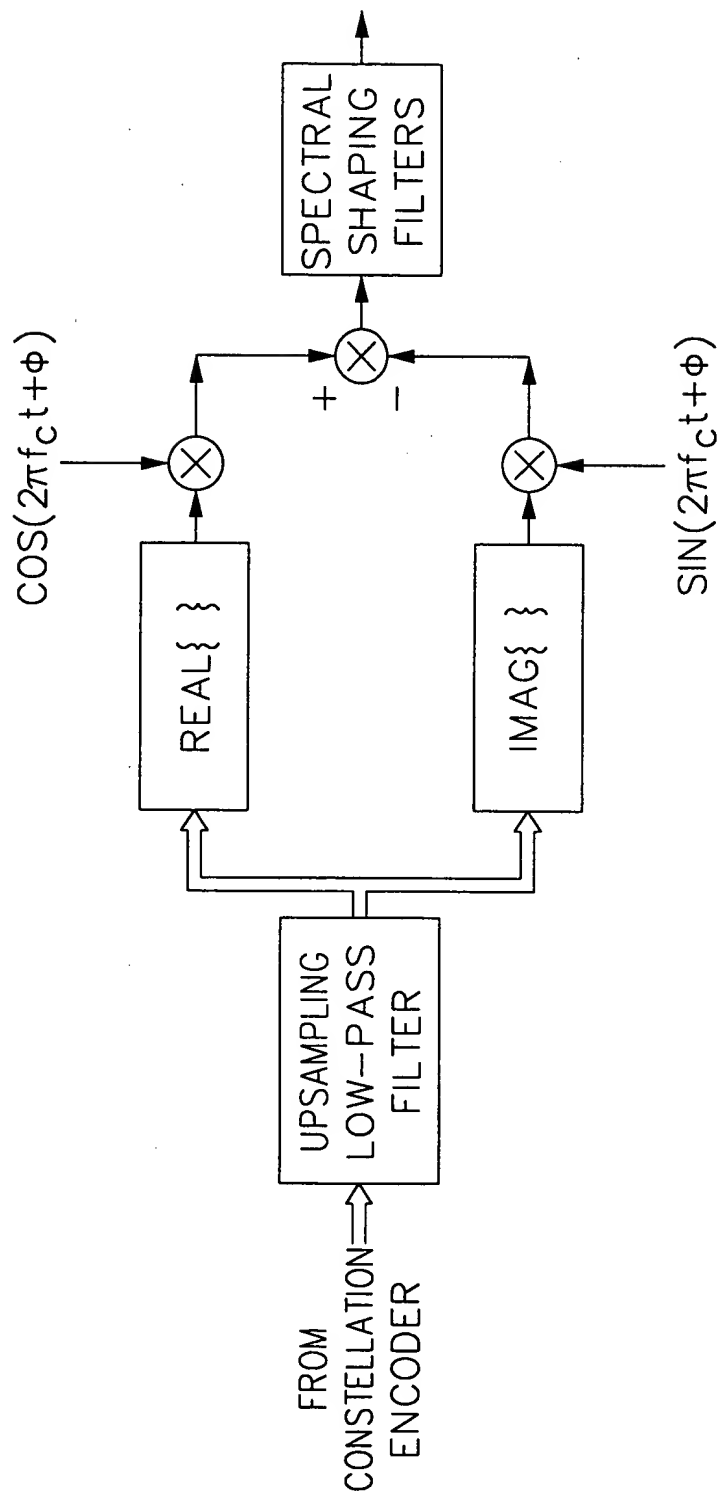


FIG. 16

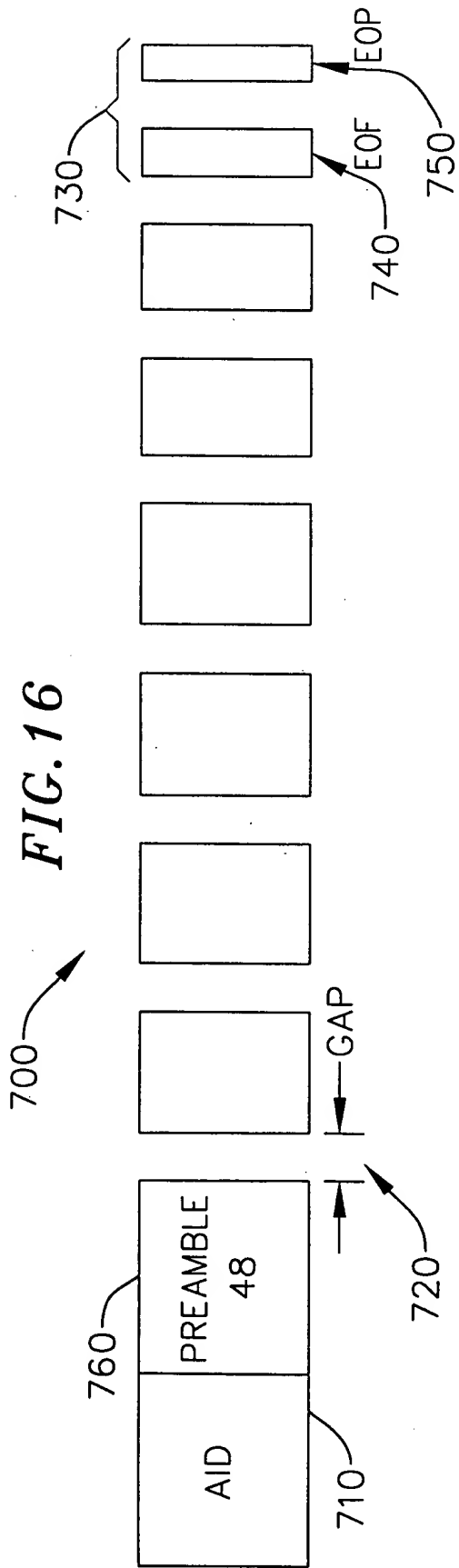


FIG. 17

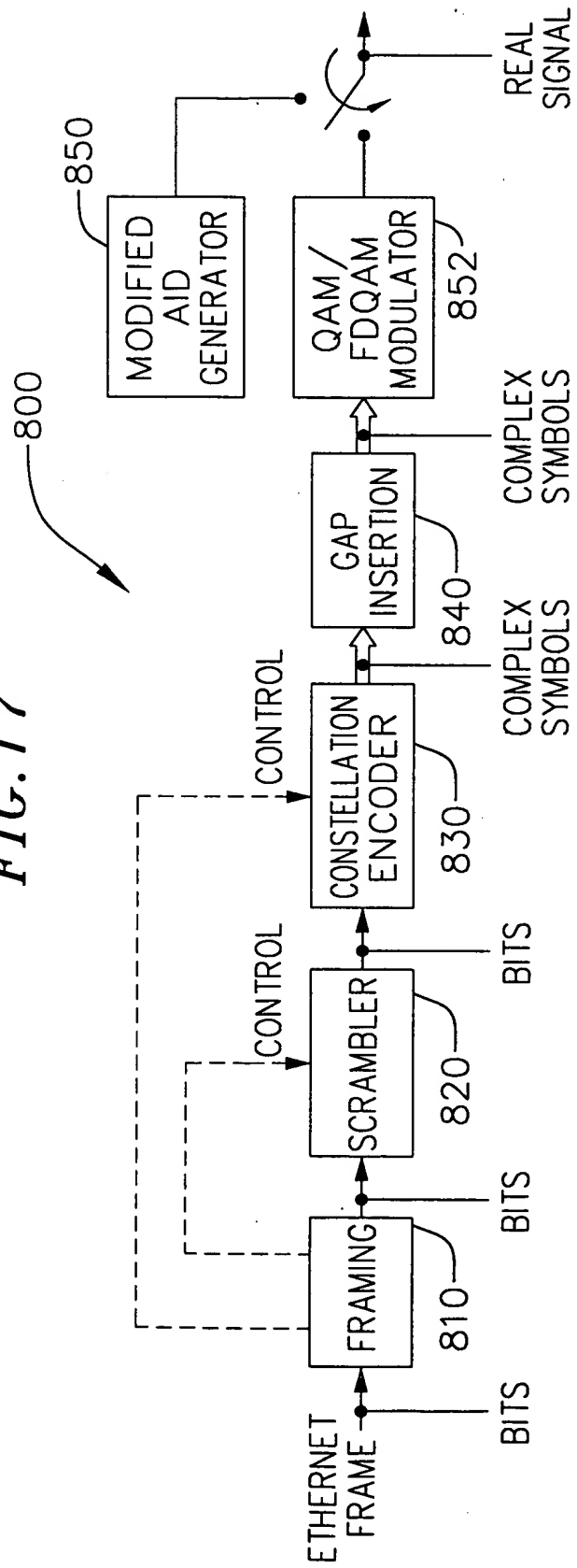


FIG. 18

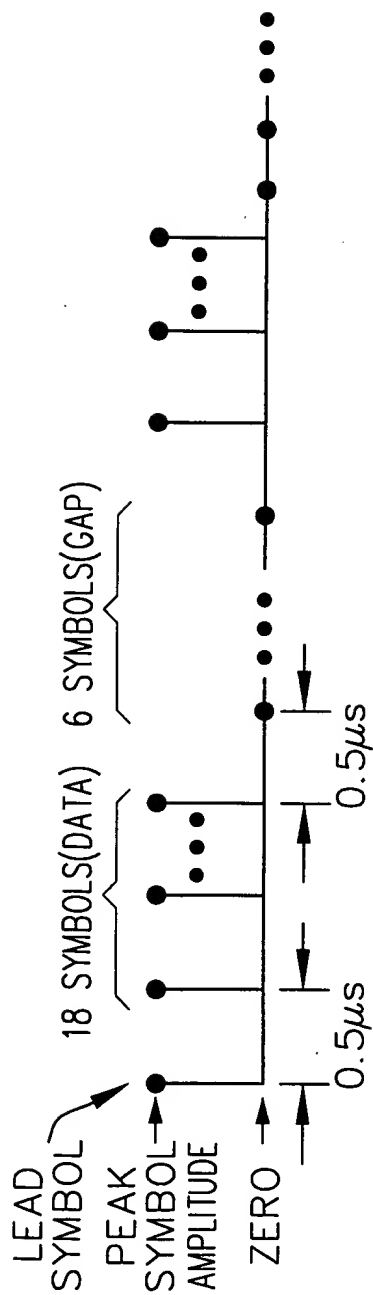


FIG. 19

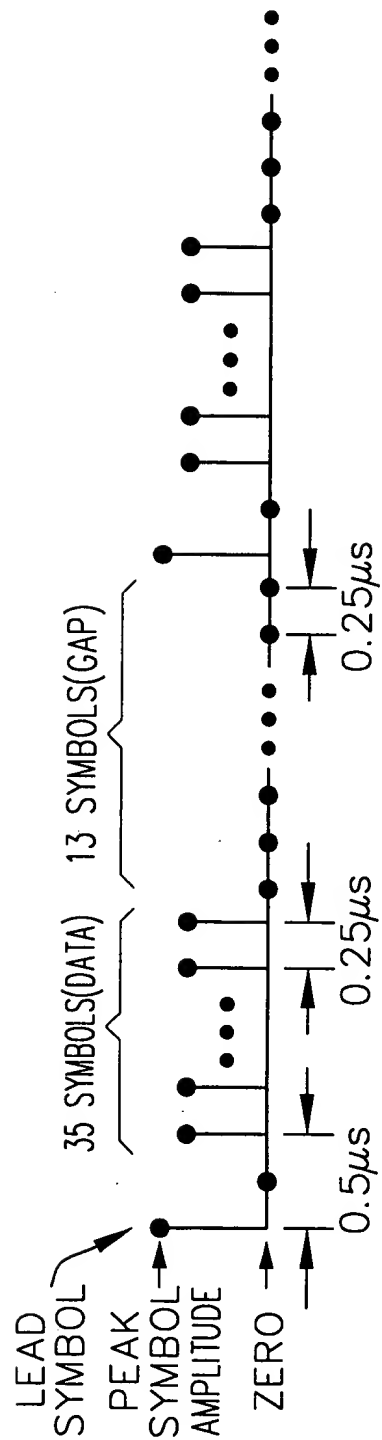
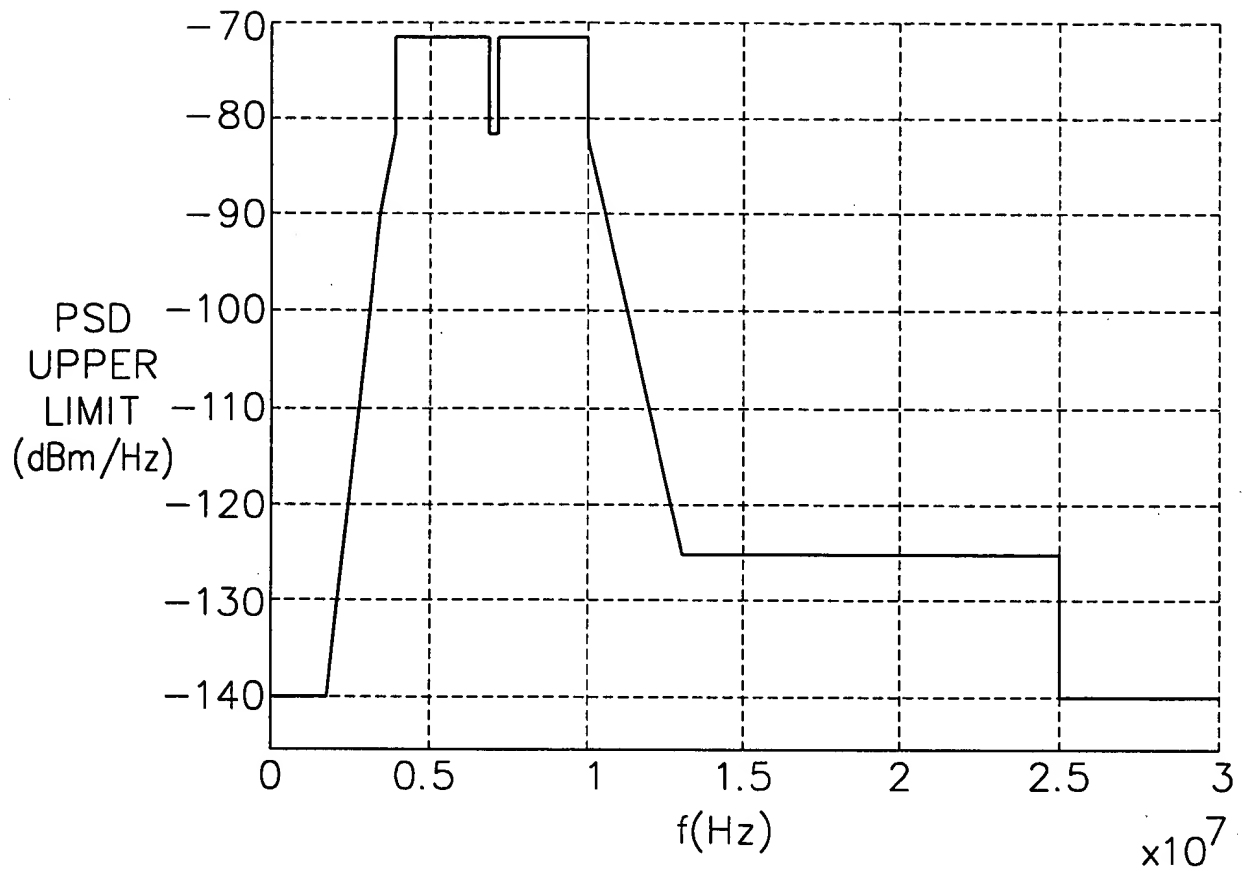


FIG.20

M MODULO 2	P MODULO 2	EOF/EOP SEQUENCE
0	0	<ul style="list-style-type: none"> • 4 SYMBOLS, DEFINED BY THE BITS 0xfc • 12 ZERO SYMBOLS • 1 SYMBOL, DEFINED BY THE BITS 00
0	1	<ul style="list-style-type: none"> • 4 SYMBOLS, DEFINED BY THE BITS 0x03 • 12 ZERO SYMBOLS • 1 SYMBOL, DEFINED BY THE BITS 11
1	0	<ul style="list-style-type: none"> • 4 SYMBOLS, DEFINED BY THE BITS 0x03 • 12 ZERO SYMBOLS • 1 SYMBOL, DEFINED BY THE BITS 11
1	1	<ul style="list-style-type: none"> • 4 SYMBOLS, DEFINED BY THE BITS 0xfc • 12 ZERO SYMBOLS • 1 SYMBOL, DEFINED BY THE BITS 00



FIG.23a*FIG.23b*

FREQUENCY(MHz)	PSD LIMIT(dBm/Hz)
$0.015 < f \leq 1.7$	-140
$1.7 < f \leq 3.5$	$-140 + (f - 1.7) * 50.0 / 1.8$
$3.5 < f \leq 4.0$	$-90 + (f - 3.5) * 17.0$
$4.0 < f \leq 7.0$	-71.5
$7.0 < f \leq 7.3$	-81.5
$7.3 < f \leq 10.0$	-71.5
$10.0 < f \leq 13.0$	$-81.5 - (f - 10.0) * 43.5 / 3.0$
$13.0 < f \leq 25.0$	-125
$25.0 < f \leq 30.0$	-140

FIG.24

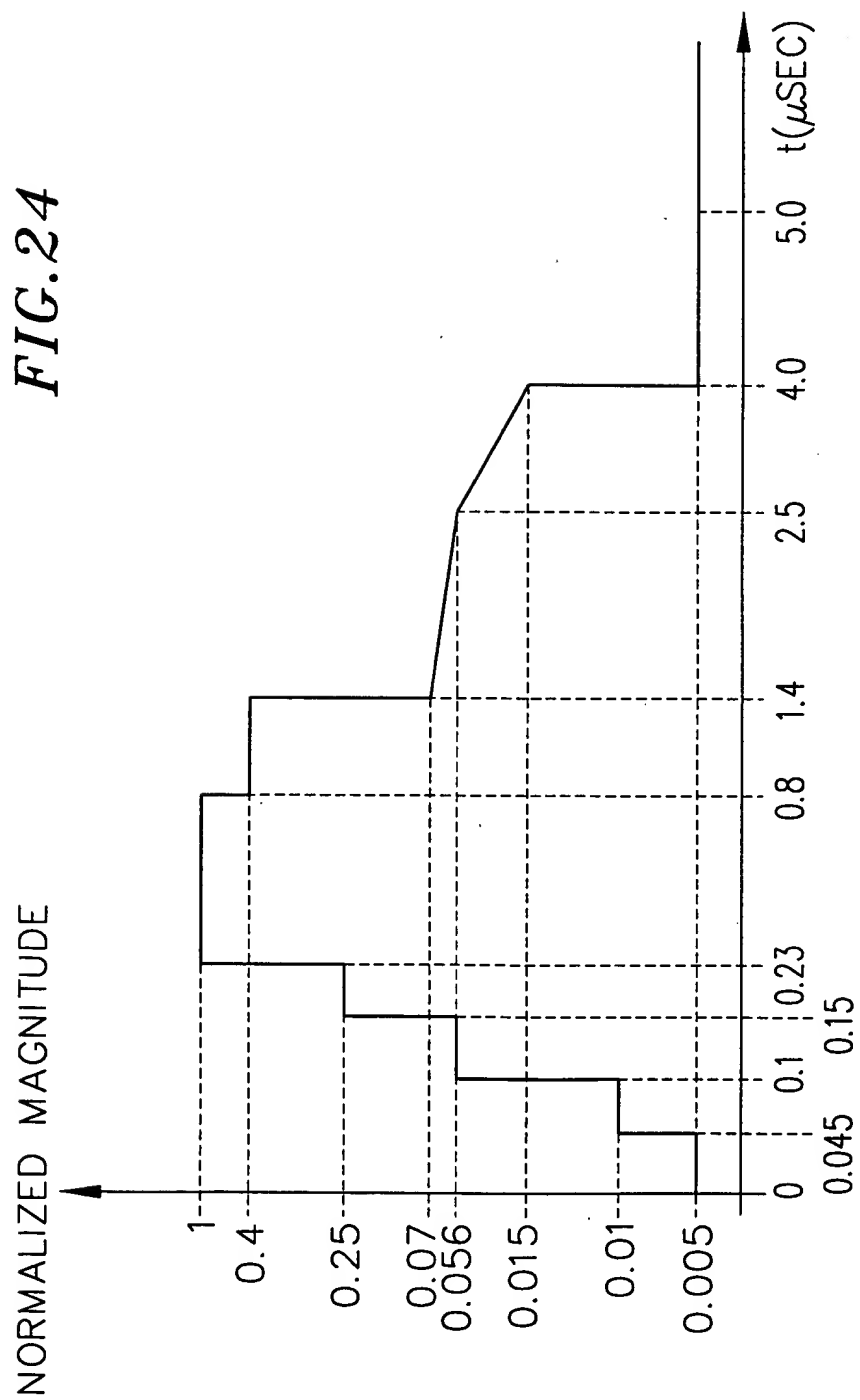


FIG. 28

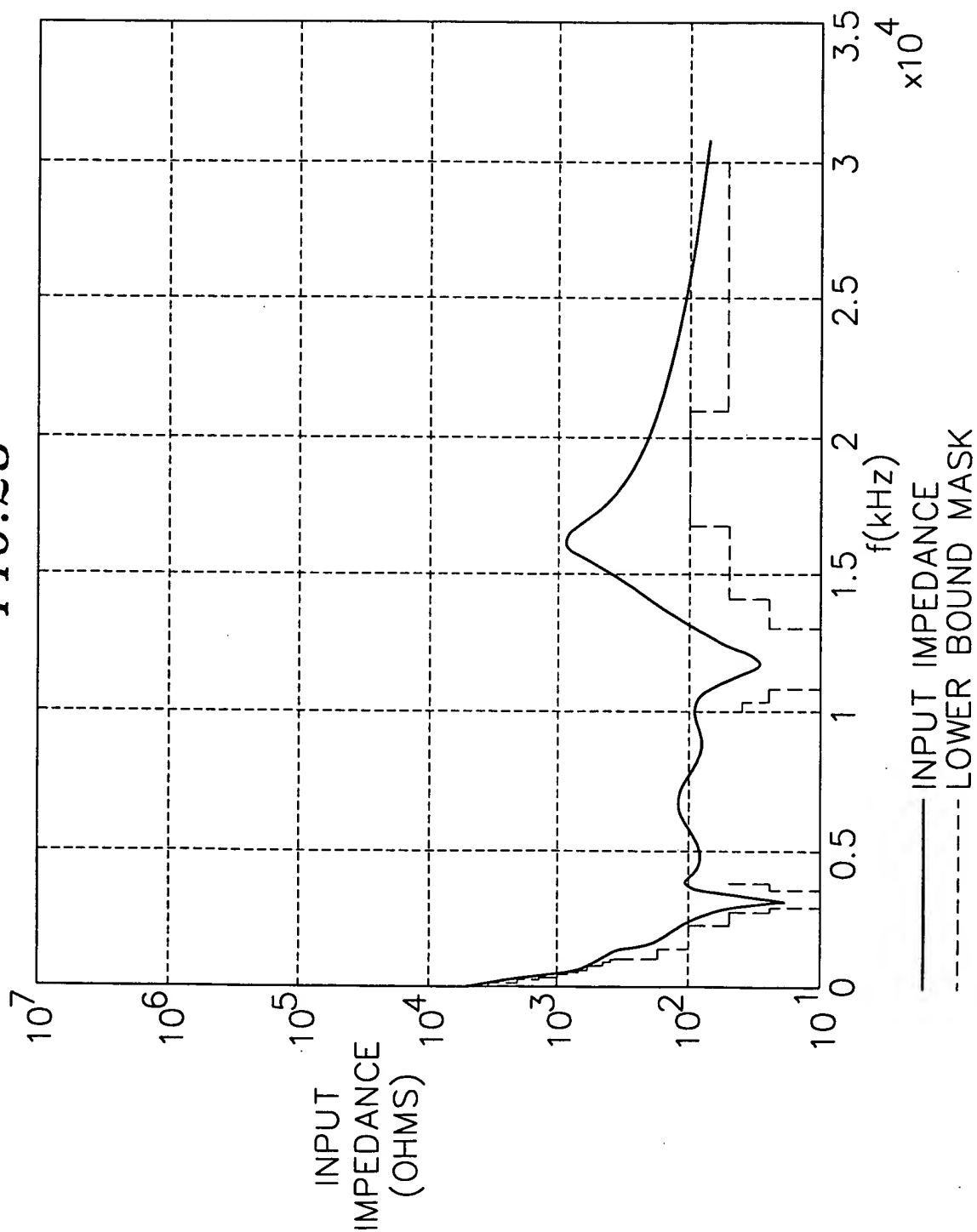


FIG.25

FREQUENCY RANGE(MHz)	MAXIMUM PEAK-TO- PEAKINTERFERER LEVEL(VOLTS)
0.01-0.1	6.0
0.1-0.6	3.3
0.6-1.7	1.0
1.7-4.0	0.1
7.0-7.3	0.1
10.0-10.15	0.1
14.0-14.35	0.28
18.068-18.168	0.5
21.0-21.45	0.5
24.89-24.99	0.5
28.0-29.7	0.5

FIG.26

FREQUENCY RANGE(MHz)	MAXIMUM PEAK-TO- PEAKINTERFERER LEVEL(VOLTS)
0.01-0.1	20.0
0.1-0.6	20.0
0.6-1.7	10.0
1.7-4.0	2.5
7.0-7.3	2.5
10.0-10.15	2.5
14.0-14.35	5.0
18.068-18.168	5.0
21.0-21.45	5.0
24.89-24.99	5.0
28.0-29.7	5.0

FIG.27

FREQUENCY RANGE(kHz)	MIN.IMPEDANCE(OHMS)
$0 < f \leq 0.285$	1 M
$0.285 < f \leq 2.85$	100 k
$2.85 < f \leq 28.5$	10 k
$28.5 < f \leq 95$	4.0 k
$95 < f \leq 190$	2.0 k
$190 < f \leq 285$	1.4 k
$285 < f \leq 380$	1.0 k
$380 < f \leq 475$	850
$475 < f \leq 570$	700
$570 < f \leq 665$	600
$665 < f \leq 760$	525
$760 < f \leq 855$	450
$855 < f \leq 950$	400
$950 < f \leq 1000$	350
$1000 < f \leq 1400$	175
$1400 < f \leq 2300$	100
$2300 < f \leq 2850$	50
$2850 < f \leq 3085$	25
$3085 < f \leq 3725$	10
$3725 < f \leq 3935$	25
$3935 < f \leq 4000$	50
$10000 < f \leq 10450$	40
$10450 < f \leq 10925$	25
$10925 < f \leq 13125$	10
$13125 < f \leq 14175$	25
$14175 < f \leq 16800$	50
$16800 < f \leq 21000$	100
$21000 < f \leq 30000$	50

FIG. 30

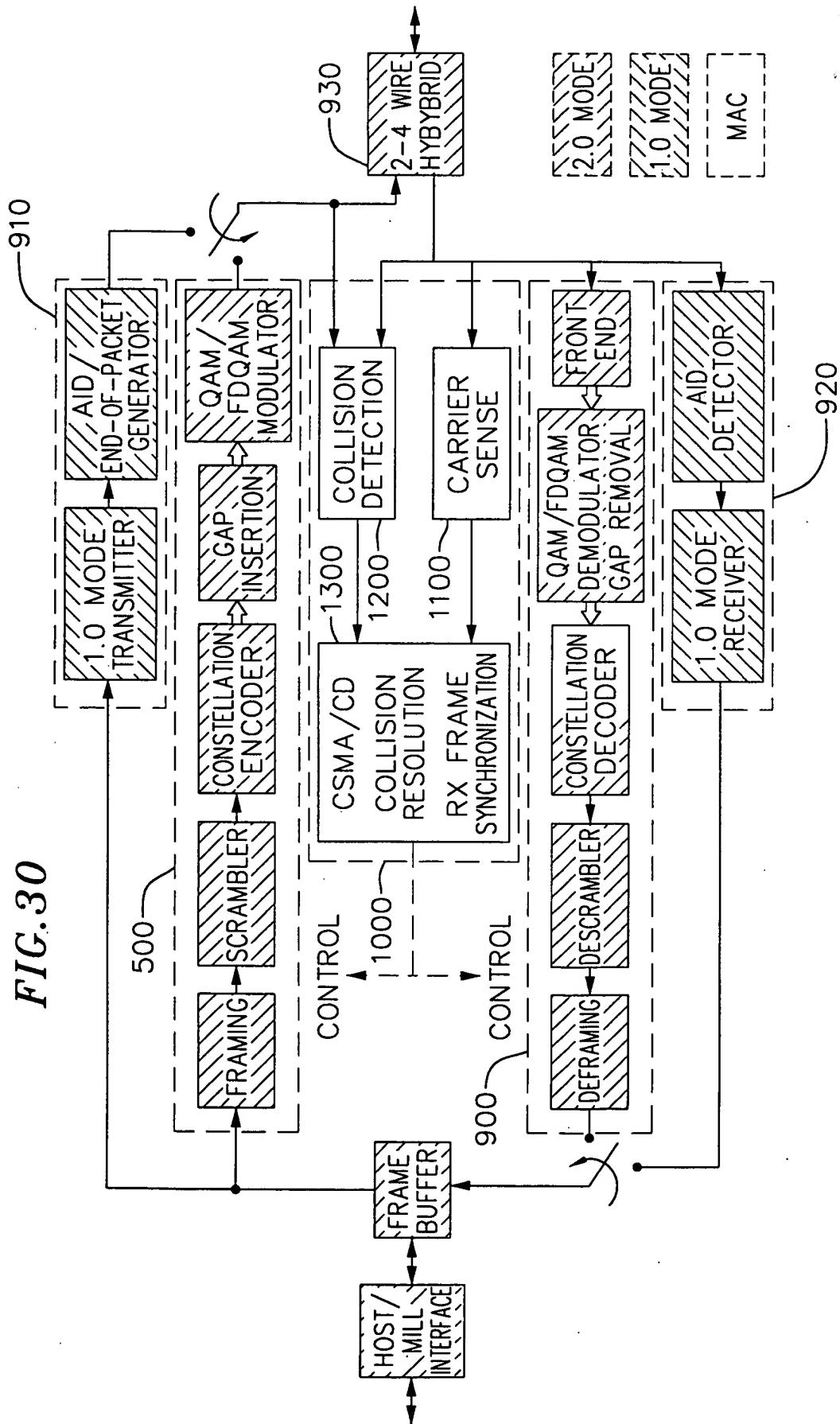


FIG. 34a

WITHOUT PRIORITY ACCESS:

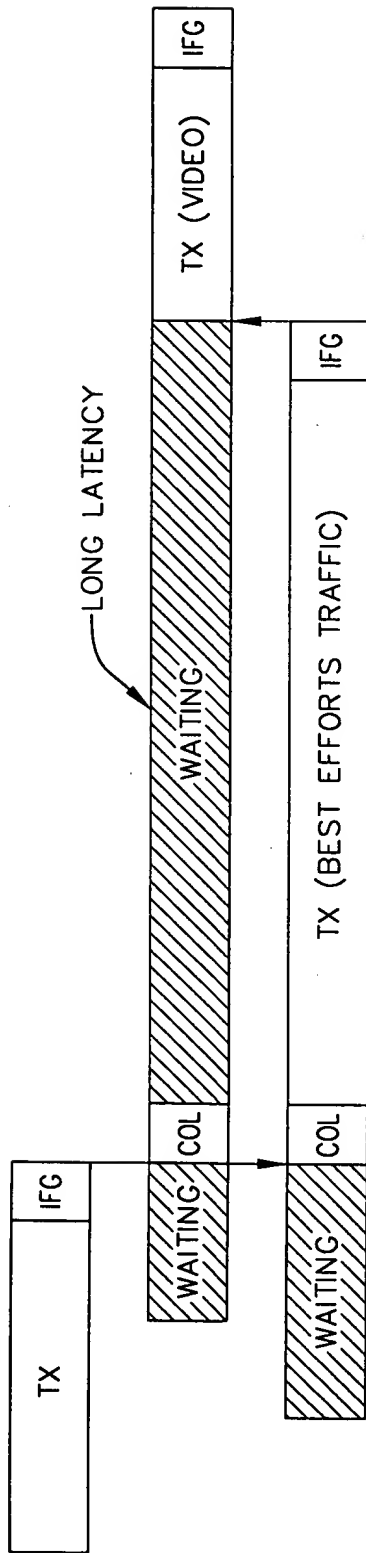


FIG. 34b

WITH PRIORITY ACCESS:

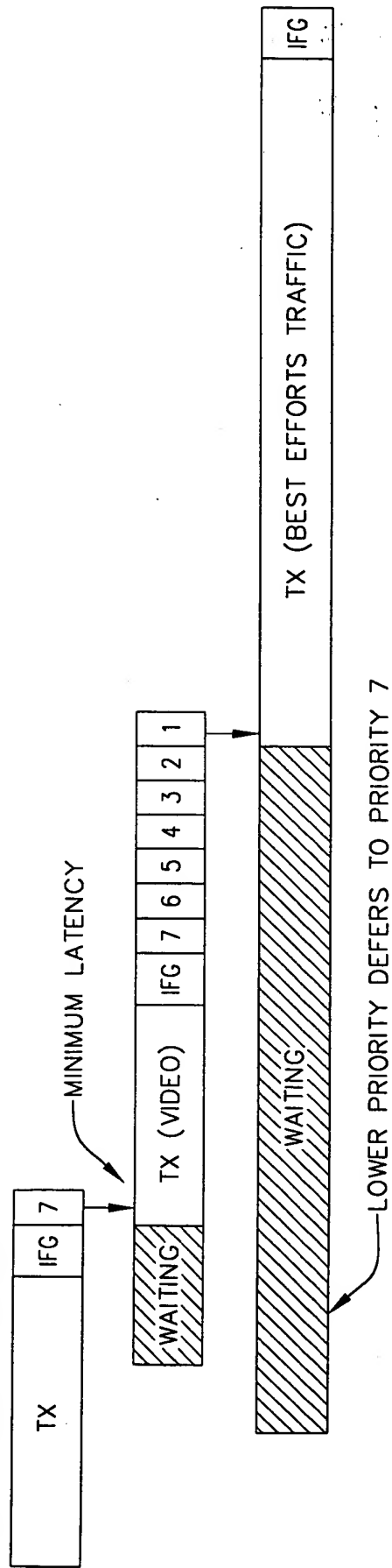


FIG.35

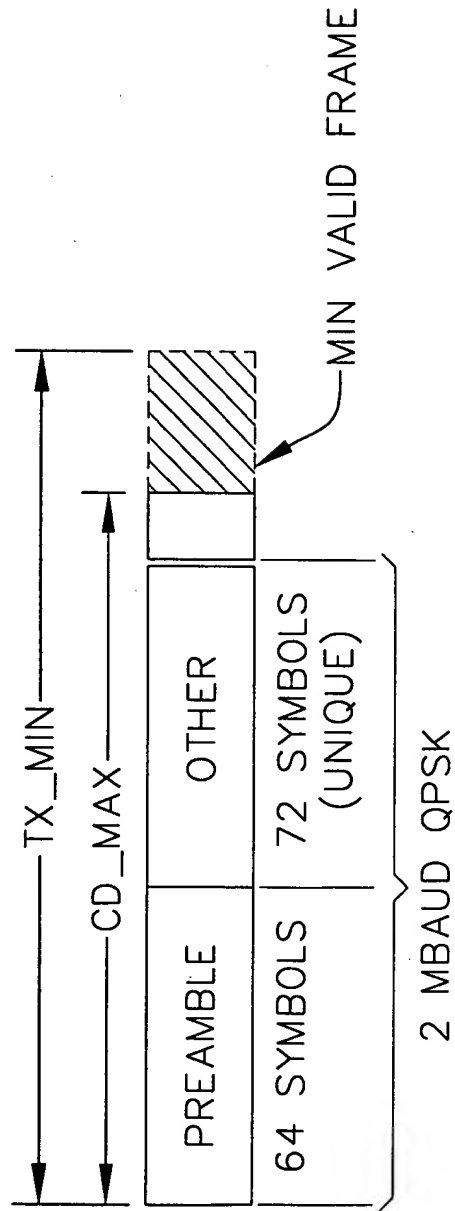


FIG.39

FIELD	LENGTH	MEANING
DA	6 OCTETS	DESTINATION ADDRESS
SA	6 OCTETS	SOURCE ADDRESS
ETHERTYPE	2 OCTETS	0x886c (LINK CONTROL FRAME)
SSTYPE	1 OCTET	=1
SSLENGTH	1 OCTET	NUMBER OF ADDITIONAL OCTETS IN THE CONTROL HEADER, STARTING WITH THE SSVERSION FIELD AND ENDING WITH THE SECOND(LAST) OCTET OF THE NEXT ETHERTYPE FIELD. THE MINIMUM VALUE OF SSLENGTH IS 8 FOR SSVERSION 0.
SSVERSION	1 OCTET	=0
OPCODE	1 OCTET	OPERATION CODE FOR THIS CONTROL MESSAGE.
NUMBANDS	1 OCTET	NUMBER OF BANDS SPECIFIED IN THIS CONTROL. EACH BAND HAS A TWO OCTET DESCRIPTOR. THE FIRST BAND REFERS TO 2 MBAUD MODULATION RATE, THE NEXT TO 4 MBAUD. NUMBANDS SHALL BE 1 OR 2 ON TRANSMISSION FOR 10M8 STATIONS, AND STATIONS SHALL IGNORE BAND ENTRIES BEYOND BAND2 ON RECEIVE IF NUMBANDS IS LARGER THAN 2. THE VALUE 0 IS NOT ALLOWED.
NUMADDR	1 OCTET	NUMBER OF ADDRESSES SPECIFIED IN THE PAYLOAD OF THIS CONTROL MESSAGE. NUMADDR MAY BE ZERO. THE SA IN THE ETHERNET HEADER IS ALWAYS USED, AND IS REFERRED TO IN THE FOLLOWING SECTIONS AS REFADDR0.
BAND1_PE	1 OCTET	2MBAUD, 7 MHz CARRIER: THE PE VALUE THAT SHOULD BE USED TO SEND DATA WHEN THE 2MBAUD BAND IS SELECTED. (1..8)ARE THE ONLY VALID VALUES. THE VALUE 8 IS USED TO REQUEST HPNA 1.0 TYPE FRAMES, AND IS VALID ONLY WHEN THE NETWORK IS OPERATING IN VIM2MODE, AND ONLY IN BAND 1.
BAND1_RANK	1 OCTET	THE RANK ORDER OF THE REQDAS' PREFERENCE FOR THIS BAND, 1 IS HIGHEST PREFERENCE, AND THE OTHER BANDS ARE ASSIGNED SUCCESSIVELY LARGER RANK VALUES, NO TWO BANDS SHALL HAVE THE SAME RANK.
BAND2_PE	1 OCTET	OPTIONAL, ONLY PRESENT IF NUMBANDS>=2. 4MBAUD, 7 MHz CARRIER: IF INCLUDED, THIS FIELD IS THE PE VALUE THAT SHOULD BE USED TO SEND DATA WHEN THE 4MBAUD BAND IS SELECTED, (0,9..15) ARE THE ONLY VALID VALUES.
BAND2_RANK	1 OCTET	OPTIONAL, ONLY PRESENT IF NUMBANDS>=2. RANK ORDER OF REQDAS' PREFERENCE FOR THIS BAND.
REFADDR1	6 OCTETS	OPTIONAL. PRESENT IF NUMADDR>=1. THE SECOND MAC ADDRESS FOR WHICH THE RATES ARE BEING SPECIFIED, TYPICALLY BROADCAST OR A MULTICAST ADDRESS.
REFADDR2	6 OCTETS	OPTIONAL. PRESENT IF NUMADDR>=2. THE THIRD MAC ADDRESS FOR WHICH THE RATES ARE BEING SPECIFIED.
...		[ADDITIONAL INSTANCES OF REFADDR, UNTIL THE NUMBER OF REFADDR FIELDS EQUALS NUMADDR]
NEXT ETHERTYPE	2 OCTETS	=0
PAD		TO REACH MINFRAMESIZE IF REQUIRED
FCS	4 OCTETS	FRAME CHECK SEQUENCE

FIG. 40

PE	DATA RATE	MEANING
0	N/A	MEANS THIS BAND IS NOT SUPPORTED
1	4 MBIT/S	2 MBAUD FDQAM, 2 BITS PER BAUD
2	6 MBIT/S	2 MBAUD FDQAM, 3 BITS PER BAUD
3	8 MBIT/S	2 MBAUD FDQAM, 4 BITS PER BAUD
4	10 MBIT/S	2 MBAUD FDQAM, 5 BITS PER BAUD
5	12 MBIT/S	2 MBAUD FDQAM, 6 BITS PER BAUD
6	14 MBIT/S	2 MBAUD FDQAM, 7 BITS PER BAUD
7	16 MBIT/S	2 MBAUD FDQAM, 8 BITS PER BAUD
8	1 MBIT/S	HPNA 1.0
9	8 MBIT/S	4 MBAUD QAM, 2 BITS PER BAUD
10	12 MBIT/S	4 MBAUD QAM, 3 BITS PER BAUD
11	16 MBIT/S	4 MBAUD QAM, 4 BITS PER BAUD
12	20 MBIT/S	4 MBAUD QAM, 5 BITS PER BAUD
13	24 MBIT/S	4 MBAUD QAM, 6 BITS PER BAUD
14	28 MBIT/S	4 MBAUD QAM, 7 BITS PER BAUD
15	32 MBIT/S	4 MBAUD QAM, 8 BITS PER BAUD

FIG. 41

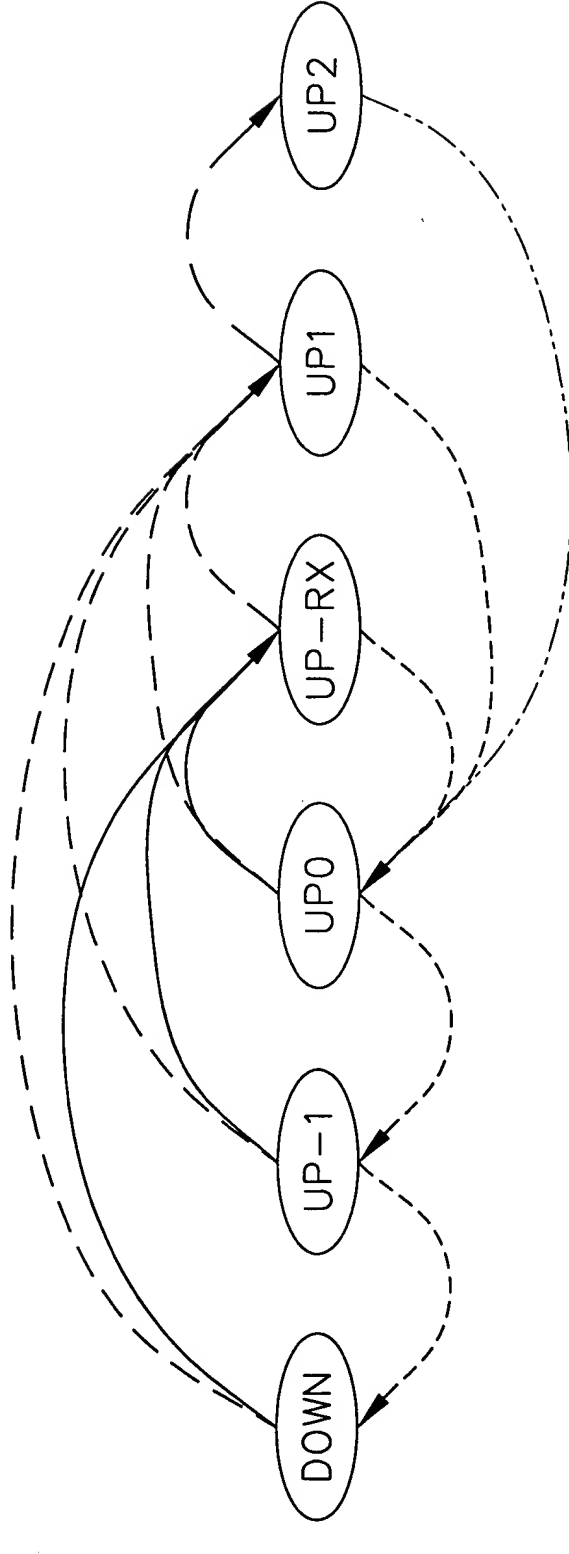
OPCODE	MEANING
0	RATE CHANGE REQUEST
1	RATE TEST REQUEST
2	RATE TEST REPLY
3-255	RESERVED

00000001 040404

FIG.42

BAND SPECIFICATION	A PAYLOAD ENCODING (PE) AND RANK ASSOCIATED WITH A GIVEN BAND. A BAND IS A SINGLE COMBINATION OF BAUD RATE, MODULATION TYPE (E.G. QAM OR FDQAM) AND CARRIER FREQUENCY. TWO BANDS ARE DEFINED IN HPNAVZ
LOGICAL CHANNEL, CHANNEL	A FLOW OF FRAMES FROM A SENDER TO ONE OR MORE RECEIVERS ON A SINGLE NETWORK SEGMENT, CONSISTING OF ALL THE FRAMES WITH A SINGLE COMBINATION OF DA AND SA.
RECEIVER	A STATION THAT RECEIVES FRAMES SENT ON A PARTICULAR CHANNEL. IF THE DESTINATION IS A UNICAST ADDRESS THERE IS AT MOST ONE RECEIVER. IF THE DESTINATION IS A GROUP ADDRESS (INCLUDING BROADCAST), THERE MAY BE MANY RECEIVERS.
RECEIVER PE	THE PREFERRED PE TO BE USED ON THIS CHANNEL, AS DETERMINED BY THE RECEIVER.
RRCF	RATE REQUEST CONTROL FRAME. SENT FROM THE RECEIVER TO THE SENDER TO EFFECT A CHANGE IN PE.
REFADDR0	THE SA IN THE ETHERNET HEADER OF THE RRCF FRAME. THIS IS THE DA OF THE RECEIVER (FOR THE CHANNEL), AND IS ALWAYS USED BY THE CHANNEL SENDER AS THE FIRST REFADDR PROCESSED.
REFADDR1.. REFADDR<n>	OTHER ADDRESSES INCLUDING BROADCAST AND MULTICAST ADDRESSES FOR WHICH THE RECEIVER IS INDICATING RATE INFORMATION TO THE SENDER. THE CHANNEL RECEIVER'S STATION ADDRESS (REFADDR0) SHOULD NOT BE PUT IN THE LIST OF ADDITIONAL REFADDR'S. NOTE 1: AT LEAST ONE REFADDR FIELD IS NECESSARY TO SUPPORT RATE NEGOTIATION FOR BROADCAST AND MULTICAST ADDRESSES SINCE THESE CANNOT BE USED AS THE SOURCE ADDRESS IN THE ETHERNET HEADER.
SENDER	THE SENDING STATION FOR A CHANNEL, USUALLY THE STATION OWNING THE SOURCE MAC ADDRESS.
SENDER PE	THE PREFERRED PE ASSOCIATED WITH A CHANNEL, AS NOTED BY THE SENDER.

FIG. 43a



—→RECEIVE ANY NON-BROADCAST FRAME OR LINK INDICATION

— — — — — → RECEIVE A FRAME WITH DA==BROADCAST (0xFFFFFFFFFFFF) — SET SA1=SA

—→RECEIVE A FRAME WITH DA==BROADCAST (0xFFFFFFFF) AND SA !=SA1

----->TIMEOUT OF 1 SECOND FREE-RUNNING TIMER-SEND LICF, REINITIALIZE FORCE_SEND

```

----->TIMEOUT-IF FORCE_SEND==0 THEN SEND LICF, REINIT FORCE_SEND ELSE DECREMENT FORCE_SEND

```


FIG.44

FIELD	LENGTH	MEANING
DA	6 OCTETS	DESTINATION ADDRESS (FF.FF.FF.FF.FF.FF)
SA	6 OCTETS	SOURCE ADDRESS
ETHERTYPE	2 OCTETS	0x886c (LINK CONTROL FRAME)
SSTYPE	1 OCTET	=2
SSLENGTH	1 OCTET	NUMBER OF ADDITIONAL OCTETS IN THE CONTROL HEADER, STARTING WITH THE SSVERSION FIELD AND ENDING WITH THE SECOND(LAST) OCTET OF THE NEXT ETHERTYPE FIELD. MINIMUM IS 4 FOR SSVERSION 0.
SSVERSION	1 OCTET	=0
LI_PAD	1 OCTET	IGNORED ON RECEPTION.
NEXT ETHERTYPE	2 OCTETS	=0
PAD	41 OCTETS	ANY VALUE OCTET
FCS	4 OCTETS	

FIG.45

FIELD	LENGTH	MEANING
DA	6 OCTETS	DESTINATION ADDRESS(FF.FF.FF.FF.FF.FF)
SA	6 OCTETS	SOURCE ADDRESS OF THE STATION THAT TRANSMITTED THIS FRAME
ETHERTYPE	2 OCTETS	0x886c (LINK CONTROL FRAME)
SSTYPE	1 OCTET	=3
SSLENGTH	1 OCTET	NUMBER OF ADDITIONAL OCTETS IN THE CONTROL HEADER, STARTING WITH THE SSVERSION FIELD AND ENDING WITH THE SECOND(LAST) OCTET OF THE NEXT ETHERTYPE FIELD. MINIMUM IS 32 FOR SSVERSION 0.
SSVERSION	1 OCTET	=0
CSA_ID_SPACE	1 OCTET	IDENTIFIES THE REGISTRATION SPACE OF CSA_MFR_ID 0-UNSPECIFIED 1-JEDEC 2-PCI
CSA_MFR_ID	2 OCTETS	HW MANUFACTURER ID-IDENTIFIES THE MANUFACTURER OF THE PHY CONTROLLER CHIP. THE PURPOSE OF THIS FIELD PLUS THE PART NUMBER AND REVISION IS TO IDENTIFY SPECIFIC IMPLEMENTATIONS OF THE PHY SPECIFICATION. THIS IS NOT A BOARD OR ASSEMBLY-LEVEL IDENTIFIER.
CSA_PART_NO	2 OCTETS	HW MANUFACTURER PART NUMBER-THE PART NUMBER OF THE PHY CONTROLLER CHIP.
CSA_REV	1 OCTET	HW REVISION
CSA_OPCODE	1 OCTET	0-ANNOUNCE 1-REQUEST
CSA_MTU	2 OCTETS	MAXIMUM SIZE LINK-LEVEL PDU THIS RECEIVER ACCEPTS IN OCTETS, THE DEFAULT VALUE IS 1526 OCTETS. THIS IS ALSO THE MINIMUM VALUE THAT SHALL BE ACCEPTED BY ALL ILINE10 STATIONS.
CSA_SA	6 OCTETS	SOURCE ADDRESS OF THE STATION THAT GENERATED THIS CSA FRAME
CSA_PAD	2 OCTETS	RESERVED FOR VERSION 0. SHALL BE SENT AS 0, IGNORED ON RECEPTION.
CSA_CURRENTTXSET	4 OCTETS	CONFIGURATION FLAGS, PLUS ALL CURRENT IN-USE STATUS FOR THIS STATION.
CSA_OLDESTTXSET	4 OCTETS	A COPY OF THE "OLDEST" TX FLAGS FOR THIS STATIONS, FROM THE PERIOD ENDING AT LEAST ONE PERIOD (MINUTE) EARLIER.
CSA_CURRENTRXSET	4 OCTETS	THE UNION OF RECENT FLAGS RECEIVED FROM OTHER STATIONS.
NEXT ETHERTYPE	2 OCTETS	=0
PAD		PAD TO REACH MINFRAMESIZE IF NECESSARY
FCS	4 OCTETS	

DeleteSet	A computed value used to detect newly removed status information.
NewRxFlags, ReallyNewRxFlags	Computed values used to detect new status flags.

Fig. 47

CSP_Timer	A free-running timer with a period of 60 seconds.
RetransmitTimer	A one-shot timer, set to a random interval in the range 1 ms to 1000 ms, inclusive, after sending a CSA in which CSA_CurrentTxSet and CSA_OldestTxSet are different, or when a CSA is received with the CSA_Opcode set to 1 (Request). This timer is cancelled if a second CSA is sent as a result of the CSP_Timer expiring.

Fig. 48

CurrentTxSet	The set of flags that were announced during the previous CS period plus any new status and priority flags (or changed configuration/options flags) used during the current CS period, i.e. the union of PreviousTxSet and NewTxSet. This set is sent in CSA frames as CSA_CurrentTxSet.
CurrentRxSet	The union of NewRxSet, PreviousRxSet. This set is sent in CSA frames as CSA_CurrentRxSet.
CurrentInUseSet	The union of CurrentTxSet and CurrentRxSet. This set is used to determine the operational mode of the station and to modify the mapping between the LL priority of the frame and the actual PHY priority usage.

Fig. 50

FIG.52a

FIELD	LENGTH	MEANING
DA	6 OCTETS	DESTINATION ADDRESS
SA	6 OCTETS	SOURCE ADDRESS
ETHERTYPE	2 OCTETS	0x886c (LINK CONTROL FRAME)
SSTYPE	1 OCTET	=4
SSLENGTH	1 OCTET	NUMBER OF ADDITIONAL OCTETS IN THE CONTROL HEADER, STARTING WITH THE SSVERSION FIELD AND ENDING WITH THE SECOND(LAST) OCTET OF THE NEXT ETHERTYPE FIELD. SSLENGTH IS 6 FOR SSVERSION 0.
SSVERSION	1 OCTET	=0
LARQ_HDR DATA	3 OCTETS	LARQ CONTROL HEADER DATA WITH LARQ_CTL BIT=1,LARQ_NACK=0.
NEXT ETHERTYPE	2 OCTETS	=0
PAD	38 OCTETS	
FCS	4 OCTETS	FRAME CHECK SEQUENCE

FIG.52b

FIELD	LENGTH	MEANING
DA	6 OCTETS	DESTINATION ADDRESS
SA	6 OCTETS	SOURCE ADDRESS
ETHERTYPE	2 OCTETS	0x886c (LINK CONTROL FRAME)
SSTYPE	1 OCTET	=4
SSLENGTH	1 OCTET	NUMBER OF ADDITIONAL OCTETS IN THE CONTROL HEADER, STARTING WITH THE SSVERSION FIELD AND ENDING WITH THE SECOND(LAST) OCTET OF THE NEXT ETHERTYPE FIELD. SSLENGTH IS 12 FOR NACK FRAMES WITH SSVERSION 0.
SSVERSION	1 OCTET	=0
LARQ_HDR DATA	3 OCTETS	LARQ CONTROL HEADER DATA WITH LARQ_CTL BIT=1,LARQ_NACK=1..7.
NACK_DA	6 OCTETS	ORIGINAL DESTINATION ADDRESS
NEXT ETHERTYPE	2 OCTETS	=0
PAD	32 OCTETS	
FCS	4 OCTETS	FRAME CHECK SEQUENCE

FIG.52c

FIELD	LENGTH	MEANING
DA	6 OCTETS	DESTINATION ADDRESS (FROM ORIGINAL ETHERNET PDU)
SA	6 OCTETS	SOURCE ADDRESS (FROM ORIGINAL ETHERNET PDU)
ETHERTYPE	2 OCTETS	0x886c (LINK CONTROL FRAME)
SSTYPE	1 OCTET	=4
SSLENGTH	1 OCTET	NUMBER OF ADDITIONAL OCTETS IN THE CONTROL HEADER, STARTING WITH THE SSVERSION FIELD AND ENDING WITH THE SECOND(LAST) OCTET OF THE NEXT ETHERTYPE FIELD. SSLENGTH IS 6 FOR SSVERSION 0.=6
SSVERSION	1 OCTET	=0
LARQ_HDR DATA	3 OCTETS	LARQ ENCAPSULATION HEADER DATA (WITH LARQ_CTL BIT=0)
NEXT ETHERTYPE	2 OCTETS	FROM ORIGINAL ETHERNET PDU
PAYLOAD	MIN 46 OCTETS	FROM ORIGINAL ETHERNET PDU PAYLOAD
FCS	4 OCTETS	FRAME CHECK SEQUENCE

FIG.52d

OCTET	FIELD	LENGTH	MEANING
FLAGSO	LARQ_MULT	1 BIT	MULTIPLE RETRANSMISSION FLAG. 0 IN THE ORIGINAL TRANSMISSION OF A DATA FRAME. FOR RETRANSMITTED FRAMES (LARQ_RTX=1), SET TO THE VALUE OF LARQ_MULT IN THE NACK FRAME THAT CAUSED THE RETRANSMISSION. THIS CAN BE USED BY RECEIVERS TO MEASURE THE ROUND-TRIP TIMES ASSOCIATED WITH THE MISS/NACK/RECEIVE-RTX PROCESS.
	LARQ_RTX	1 BIT	0 FOR FIRST TRANSMISSION OF A FRAME, 1 IF FRAME IS RETRANSMITTED. STATIONS NOT IMPLEMENTING LARQ SHALL DROP ANY DATA FRAME IF THIS BIT IS 1.
	LARQ_NORTX	1 BIT	0 IF IMPLEMENTATION SUPPORTS RETRANSMISSION, 1 IF ONLY PRIORITY IS MEANINGFUL. MAY BE USED ON A PERCHANNEL BASIS.
	LARQ_NEWSEQ	1 BIT	1 IF THE SEQUENCE NUMBER SPACE FOR THE CHANNEL HAS BEEN RESET, AND OLDER SEQUENCE NUMBERS SHOULD NOT BE NACKED, 0 OTHERWISE.
	LARQ_CTL	1 BIT	"0" WHEN IN ENCAPSULATION FORMAT
	PRIORITY	3 BITS	LINK LAYER PRIORITY OF THIS FRAME
FLAGSI_SEQO	RESERVED	4 BITS	RESERVED, SHALL BE 0
	LARQ_SEQ_HIGH	4 BITS	HIGH 4 BITS OF SEQUENCE NUMBER
SEQ1	LARQ_SEQ_LOW	8 BITS	LOW 8 BITS OF SEQUENCE NUMBER

FIG.52e

OCTET	FIELD	LENGTH	MEANING
FLAGSO	LARQ_MULT	1 BIT	MULTIPLE RETRANSMISSION FLAG. 0 IN THE FIRST NACK SENT FOR A GIVEN SEQUENCE NUMBER, 1 IN ALL RETRANSMITTED NACKS.
	LARQ_NACK	3 BITS	NACK COUNT IF 0 IN A LARQ CONTROL FRAME, THEN THIS IS A REMINDER.
	LARQ_CTL	1 BIT	SET TO 1 FOR LARQ CONTROL HEADER DATA FORMAT
	PRIORITY	3 BITS	LINK LAYER PRIORITY OF THIS FRAME
FLAGSI_SEQO	RESERVED	4 BITS	RESERVED, SHALL BE 0
	LARQ_SEQ_HIGH	4 BITS	HIGH 4 BITS OF SEQUENCE NUMBER
SEQ1	LARQ_SEQ_LOW	8 BITS	LOW 8 BITS OF SEQUENCE NUMBER

FIG.52f.1

CONTROL FRAME	A FRAME GENERATED BY A LARQ PROTOCOL MODULE THAT CONTAINS ONLY A LARQ PROTOCOL HEADER AS ITS PAYLOAD.
CURRENT SEQUENCE NUMBER	THE MOST RECENTLY RECEIVED NEW SEQUENCE NUMBER FOR A CHANNEL.
DATA FRAME	ANY STANDARD ETHERNET FRAME FROM HIGHER (THAN LARQ) PROTOCOL LAYERS. A LARQ-ENABLED STATION ENCAPSULATES THE ORIGINAL PAYLOAD OF AN ETHERNET FRAME BY INSERTING A LARQ HEADER (SHORTER FORM CONTROL HEADER WITH LARQ_HDR DATA) BETWEEN THE SOURCE ADDRESS AND THE REMAINDER OF THE FRAME BEFORE THE FRAME IS PASSED DOWN TO THE DRIVER FOR TRANSMISSION ON THE NETWORK.
FORGET TIMER	AN IMPLEMENTATION DEPENDENT MECHANISM TO ALLOW A RECEIVER TO RESET THE SEQUENCE NUMBER SPACE OF A CHANNEL WHEN A RECEIVED SEQUENCE NUMBER IS NOT THE NEXT EXPECTED (CURRENT SEQUENCE NUMBER+1). ONE SECOND IS A SUGGESTED DEFAULT VALUE.
HOLD TIMER, LOST TIMER	AN IMPLEMENTATION DEPENDENT TIMING MECHANISM THAT LIMITS THE TIME A RECEIVER WILL HOLD ONTO A RECEIVED FRAME WHILE WAITING FOR A MISSING FRAME TO BE RETRANSMITTED. CONCEPTUALLY, THERE IS ONE SUCH TIMER PER MISSING SEQUENCE NUMBER. THE TIMER INTERVAL IS MAXIMUM HOLD INTERVAL.
LOGICAL CHANNEL, CHANNEL	A FLOW OF FRAMES FROM A SENDER TO ONE OR MORE RECEIVERS ON A SINGLE NETWORK SEGMENT CONSISTING OF ALL THE FRAMES WITH A SINGLE COMBINATION OF DESTINATION ADDRESS, SOURCE ADDRESS, AND LINK LAYER PRIORITY.
NACK, NACK, NACK	AN INDICATION FROM A RECEIVER TO A SENDER REQUESTING RETRANSMISSION OF ONE OR MORE FRAMES. ALSO, THE ACTION OF PROVIDING SUCH AN INDICATION. E.G. "TO NACK A SEQUENCE NUMBER" MEANING TO SEND A NACK INDICATION.
NACK TIMER	AN IMPLEMENTATION DEPENDENT TIMING MECHANISM USED BY A RECEIVER TO RETRANSMIT NACKS FOR MISSING SEQUENCE NUMBERS. CONCEPTUALLY, THERE IS ONE SUCH TIMER PER MISSING SEQUENCE NUMBER PER LOGICAL CHANNEL. THE TIMER IS RESET EACH TIME A NACK IS SENT FOR A SEQUENCE NUMBER. THE TIMER INTERVAL IS NACK RETRANSMISSION INTERVAL.
NEW	A NEW SEQUENCE NUMBER IS ONE WHOSE DIFFERENCE FROM THE CURRENT SEQUENCE NUMBER FOR THE CHANNEL, MODULO THE SIZE OF THE SEQUENCE NUMBER SPACE AND CONSIDERED AS A SIGNED INTEGER, IS GREATER THAN 0. IN PARTICULAR, THE NUMBERS (CURRENT+1) THROUGH (CURRENT+2047).
OLD	AN OLD SEQUENCE NUMBER IS ONE WHOSE DIFFERENCE FROM THE CURRENT SEQUENCE NUMBER FOR THE CHANNEL, MODULO THE SIZE OF THE SEQUENCE NUMBER SPACE AND CONSIDERED AS A SIGNED INTEGER, IS LESS THAN OR EQUAL TO 0. IN PARTICULAR, THE NUMBERS (CURRENT-2048) THROUGH (CURRENT) ARE OLD. NOTE, HOWEVER, THAT MOST OF THE OLD SEQUENCE NUMBERS ARE ALSO OUT-OF-SEQUENCE.

FIG.52f.2

OUT OF SEQUENCE	ANY SEQUENCE NUMBER THAT FALLS OUTSIDE A REASONABLE RANGE, OLD OR NEW, OF THE CURRENT SEQUENCE NUMBER FOR A LOGICAL CHANNEL IS CONSIDERED OUT OF SEQUENCE. IT IS RECOMMENDED THAT PLUS OR MINUS TWICE THE VALUE OF MAXIMUMSAVELIMIT (DEFINED BELOW) BE USED AS THE "REASONABLE RANGE" WHEN CHECKING FOR OUT OF SEQUENCE.
RECEIVER	A STATION THAT RECEIVES FRAMES SENT ON A PARTICULAR CHANNEL. IF THE DESTINATION ADDRESS IS A UNICAST ADDRESS THERE IS AT MOST ONE RECEIVER. IF THE DESTINATION ADDRESS IS A GROUP ADDRESS (INCLUDING BROADCAST), THEN THERE MAY BE MANY RECEIVERS.
REMINDER	A CONTROL FRAME SENT BY THE CHANNEL SENDER WITH THE MOST RECENTLY USED SEQUENCE NUMBER FOR A CHANNEL WHICH HAS BEEN INACTIVE FOR REMINDER INTERVAL AFTER ITS MOST RECENT DATA FRAME.
REMINDER TIMER	AN IMPLEMENTATION DEPENDENT TIMING MECHANISM USED BY A SENDER TO GENERATE A REMINDER FRAME AFTER A PERIOD OF INACTIVITY FOR A CHANNEL. THE TIMER IS RESET EACH TIME A NEW DATA FRAME IS TRANSMITTED. CONCEPTUALLY, THERE IS ONE SUCH TIMER PER CHANNEL. THE TIMER INTERVAL IS REMINDER INTERVAL.
SAVE TIMER	AN IMPLEMENTATION DEPENDENT TIMING MECHANISM THAT LIMITS THE TIME A SENDER WILL SAVE A FRAME WAITING FOR RETRANSMISSION REQUESTS. THE TIMER INTERVAL IS MAXIMUM SAVE INTERVAL.
SENDER	THE SENDING STATION FOR A CHANNEL, USUALLY THE STATION OWNING THE SOURCE MAC ADDRESS.
SEQUENCE NUMBERS	SEQUENCE NUMBERS ARE MAINTAINED SEPARATELY FOR EACH LOGICAL CHANNEL BY THE SENDER.

FIG.53

SEND SEQUENCE NUMBER	THE SEQUENCE NUMBER OF THE MOST RECENTLY TRANSMITTED DATA FRAME.
REMINDER TIMER INTERVAL	A FIXED INTERVAL. THE DEFAULT IS 50 MS. LOWER VALUES WILL INCREASE THE OVERHEAD OF REMINDERS ON NETWORK LOAD, WHILE HIGHER VALUES INCREASE THE LATENCY FOR END-OF-SEQUENCE FRAMES REQUIRING RETRANSMISSION. IMPLEMENTATIONS SHOULD NOT USE VALUES OUTSIDE OF THE RANGE 25-75 MS, BASED ON 150 MS MAXIMUM SAVE AND HOLD TIMES.
MINIMUM RETRANSMISSION INTERVAL	AN INTERVAL USED TO PREVENT TOO-FREQUENT RETRANSMISSIONS OF A SINGLE FRAME. MOST IMPORTANT FOR MULTICAST CHANNELS. THE DEFAULT IS 10 MS.
MAXIMUM SAVE LIMIT	THE MAXIMUM NUMBER OF FRAMES THAT WILL BE SAVED FOR A SINGLE LOGICAL CHANNEL. THIS IMPLEMENTATION DEPENDENT, AND VARIES WITH THE MAXIMUM FRAME RATE THE SENDER IS EXPECTED TO SUPPORT. VALUES OF 100 OR MORE CAN BE USEFUL FOR HIGH-SPEED APPLICATIONS SUCH AS VIDEO.
MAXIMUM SAVE INTERVAL	THE MAXIMUM TIME THAT THE SENDER WILL NORMALLY SAVE A FRAME FOR POSSIBLE RETRANSMISSION. THE DEFAULT IS 150 MS.

FIG.54

CURRENT SEQUENCE NUMBER	THE MOST RECENT SEQUENCE NUMBER RECEIVED IN A LARQ HEADER FOR THE CHANNEL, WHETHER IN A DATA FRAME OR A REMINDER CONTROL FRAME.
OLDEST MISSING SEQUENCE NUMBER	THE OLDEST SEQUENCE NUMBER FOR A FRAME NOT YET RECEIVED WHICH HAS NOT BEEN DECLARED LOST.
MAXIMUM HOLD INTERVAL	THE LONGEST INTERVAL THAT A FRAME WILL BE HELD AWAITING AN EARLIER MISSING FRAME. THE DEFAULT IS TO USE THE SAME VALUE AS MAXIMUM SAVE INTERVAL, WHICH HAS A DEFAULT OF 150 MS.
MAXIMUM RECEIVE LIMIT	THE MAXIMUM NUMBER OF FRAMES THAT A RECEIVER WILL BUFFER WHILE AWAITING AN EARLIER MISSING FRAME. THE DEFAULT SHOULD NORMALLY BE THE SAME AS THE MAXIMUM SAVE LIMIT.
NACK RETRANSMISSION INTERVAL	THE INTERVAL AFTER WHICH A RECEIVER WILL RETRANSMIT A NACK CONTROL FRAME FOR A MISSING SEQUENCE NUMBER, WITH THE EXPECTATION THAT EARLIER NACK CONTROL FRAMES OR DATA FRAME RETRANSMISSIONS WERE LOST. THE DEFAULT FOR FIXED IMPLEMENTATIONS IS 20 MS.

FIG.55a

FIELD	LENGTH	MEANING
DA	6 OCTETS	DESTINATION ADDRESS
SA	6 OCTETS	SOURCE ADDRESS
ETHERTYPE	2 OCTETS	0x886c (LINK CONTROL FRAME)
SSTYPE	1 OCTET	=5
SSLENGTH	1 OCTET	NUMBER OF ADDITIONAL OCTETS IN THE CONTROL HEADER, STARTING WITH THE SSVERSION FIELD AND ENDING WITH THE SECOND(LAST) OCTET OF THE NEXT ETHERTYPE FIELD. SSLENGTH SHALL BE ≥ 6 FOR SSVERSION 0.
SSVERSION	1 OCTET	=0
VENDOR OUI	3 OCTETS	AN IEEE ASSIGNED ORGANIZATIONALLY UNIQUE IDENTIFIER
CONTROL DATA	0-249 OCTETS	VENDOR SPECIFIC CONTROL DATA
NEXT ETHERTYPE	2 OCTETS	= NEXT ETHERTYPE IF AN ENCAPSULATION FORMAT, OR 0 IF NO ENCAPSULATED FRAME
PAD	0-38 OCTETS	ANY VALUE OCTET
FCS	4 OCTETS	

FIG.55b

FIELD	LENGTH	MEANING
DA	6 OCTETS	DESTINATION ADDRESS
SA	6 OCTETS	SOURCE ADDRESS
ETHERTYPE	2 OCTETS	0x886c (LINK CONTROL FRAME)
LSTYPE	2 OCTETS	=32769
LSLENGTH	2 OCTETS	NUMBER OF ADDITIONAL OCTETS STARTING WITH THE LSVERSION FIELD AND ENDING WITH THE SECOND(LAST) OCTET OF THE NEXT ETHERTYPE FIELD. LSLENGTH SHALL BE ≥ 6 FOR LSVERSION 0.
LSVERSION	1 OCTET	=0
VENDOR OUI	3 OCTETS	AN IEEE ASSIGNED ORGANIZATIONALLY UNIQUE IDENTIFIER
CONTROL DATA	1-65531 OCTETS	VENDOR SPECIFIC DATA
NEXT ETHERTYPE	2 OCTETS	= NEXT ETHERTYPE IF AN ENCAPSULATION FORMAT, OR 0 IF NO ENCAPSULATED FRAME
PAD	40-0 OCTETS	IF NEEDED TO MAKE MINIMUM SIZE FRAME. SHOULD BE ZERO.
FCS	4 OCTETS	

FIG.56

CARRIER SENSE STATE	OUTPUT EVENTS
INIT	ENERGY<=0. ONLY START-OF-PREAMBLE EVENTS CHECKED.
IDLE	ONLY START-OF-PREAMBLE EVENTS CHECKED.
BUSY	ONLY END-OF-PREAMBLE EVENTS CHECKED.
TRANSMIT	ONLY START-OF-PREAMBLE EVENTS CHECKED(COLLISION DETECTION)

FIG.57

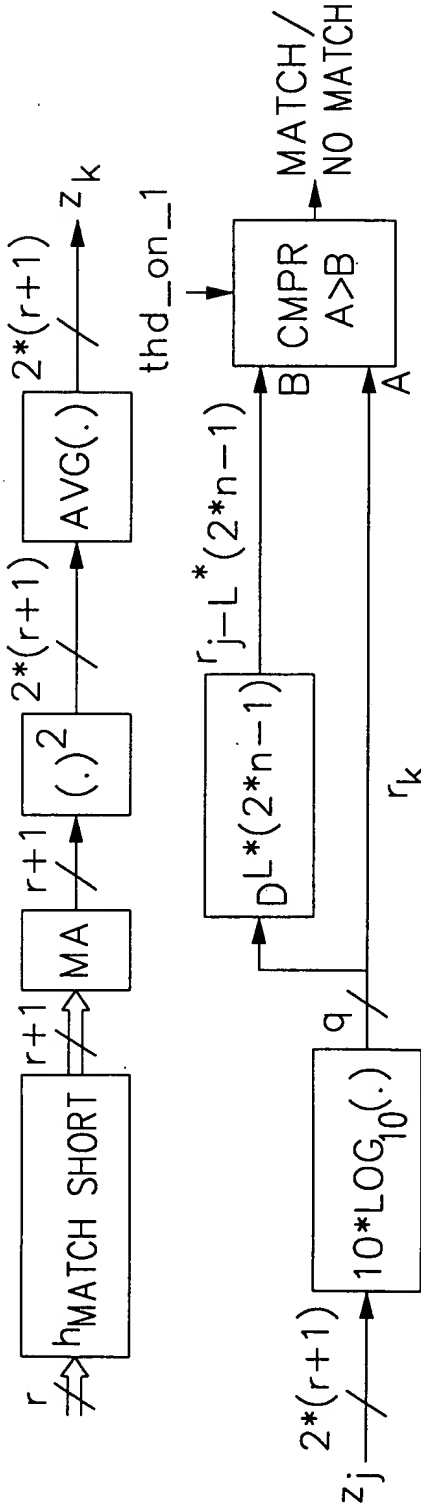


FIG. 58

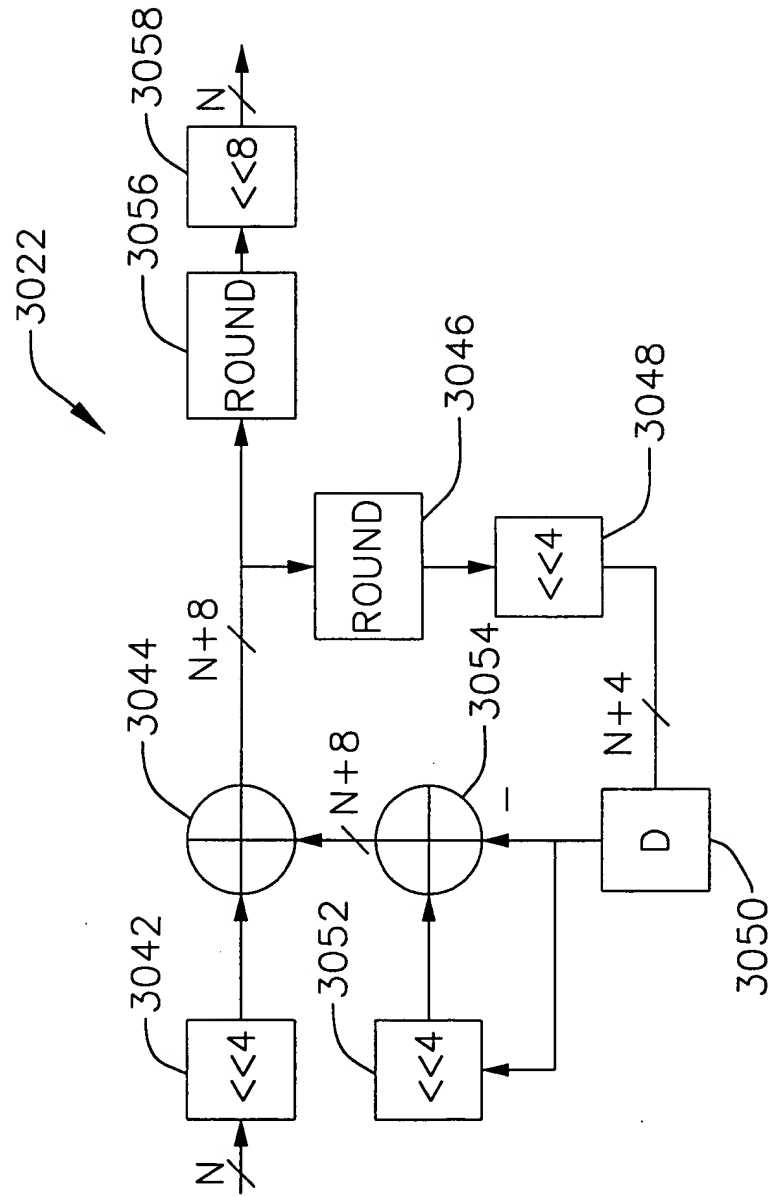


FIG. 59

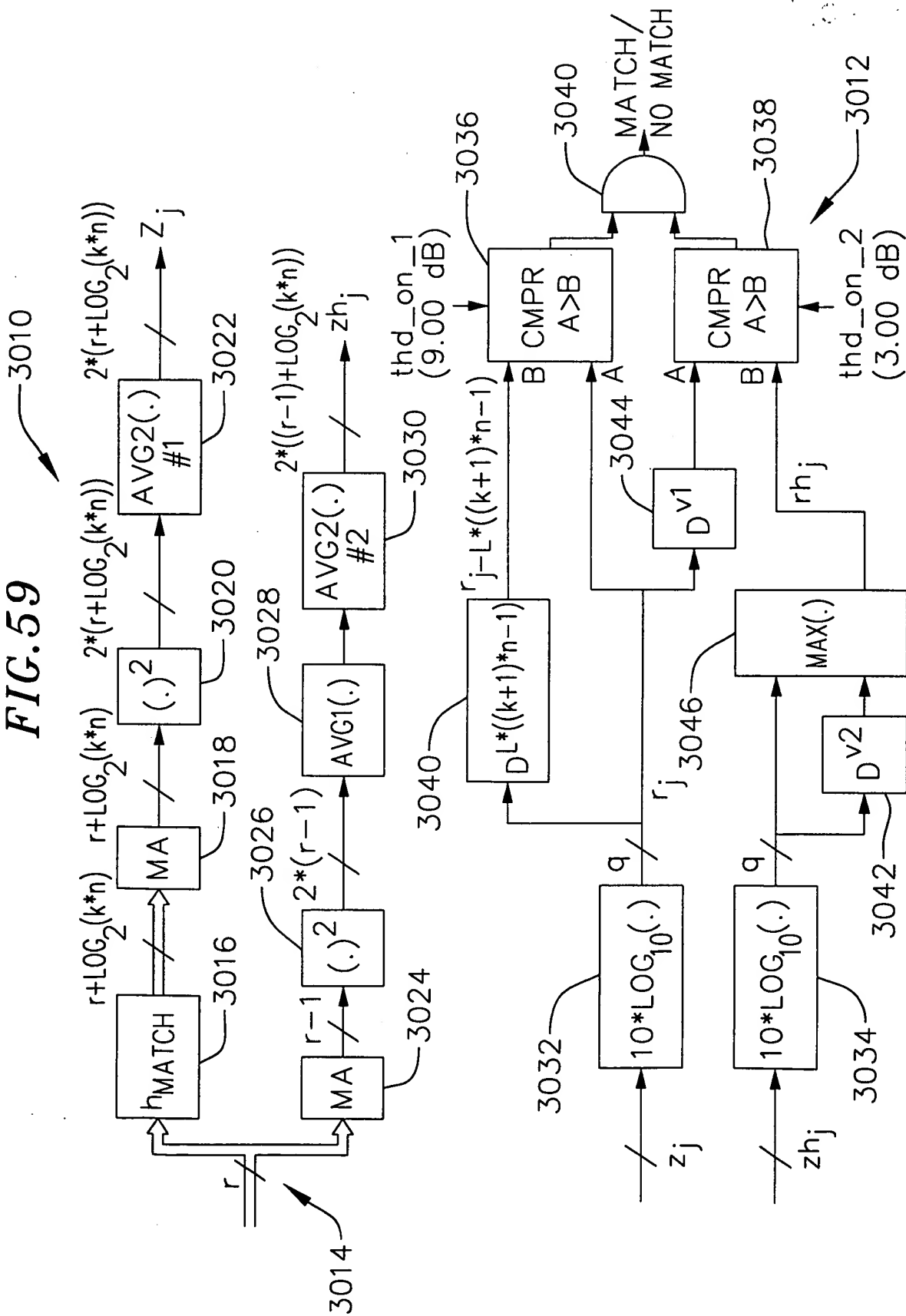


FIG.62 α

TABLE INDEX	TABLE VALUE (dB)
0	0.00
1	3.00
2	6.00
3	9.00
4	12.00
5	15.00
6	18.00
7	21.00
8	24.00
9	27.00
10	30.00
11	33.00
12	36.00
13	39.25
14	42.25
15	45.25
16	48.25
17	51.25
18	54.25
19	57.25
20	60.25
21	63.25
22	66.25
23	69.25
24	72.25
25	75.25
26	78.25
27	81.25
28	84.25
29	87.25
30	90.25
31	93.25

FIG.62b

TABLE INDEX	TABLE VALUE (dB)
0	0.00
1	0.25
2	0.25
3	0.50
4	0.50
5	0.75
6	0.75
7	0.75
8	1.00
9	1.00
10	1.25
11	1.25
12	1.50
13	1.50
14	1.50
15	1.75
16	1.75
17	1.75
18	2.00
19	2.00
20	2.00
21	2.25
22	2.25
23	2.25
24	2.50
25	2.50
26	2.50
27	2.75
28	2.75
29	2.75
30	2.75
31	3.00

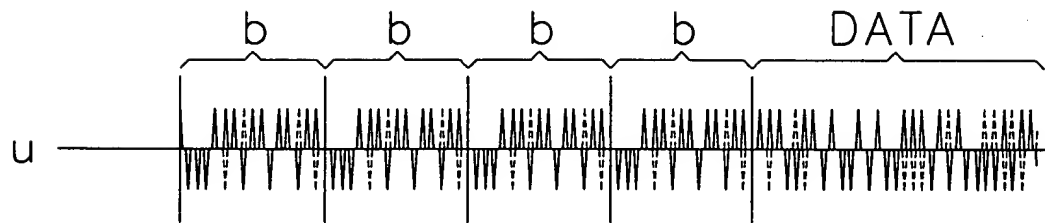
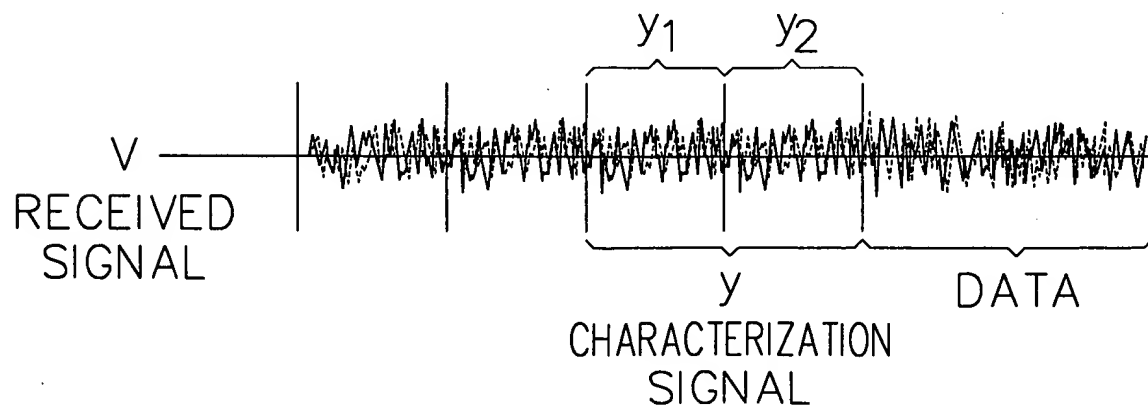
FIG. 63a*FIG. 63b**FIG. 63c*

FIG. 64

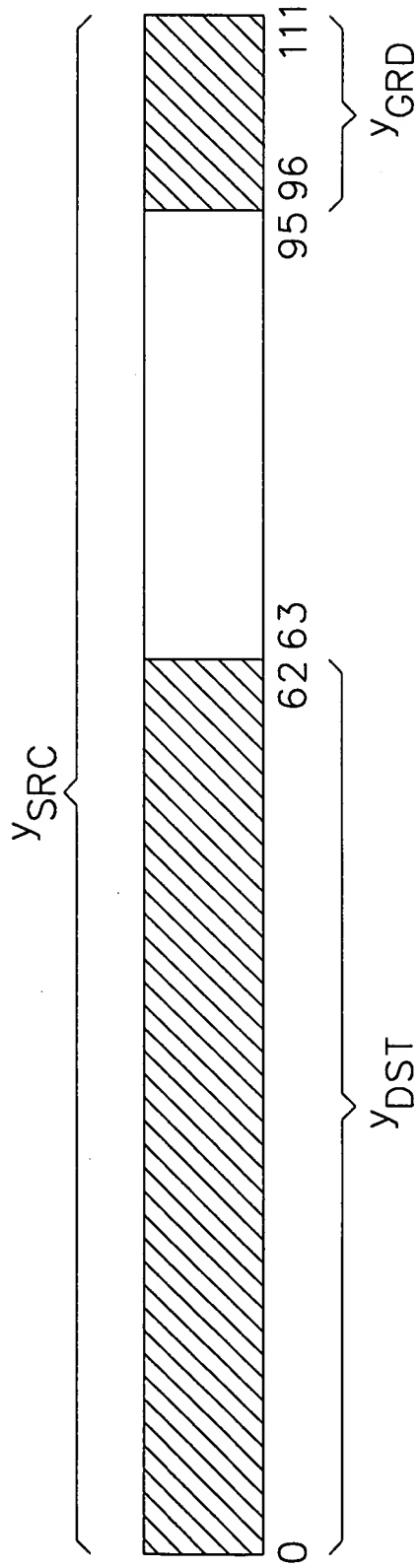


FIG. 65

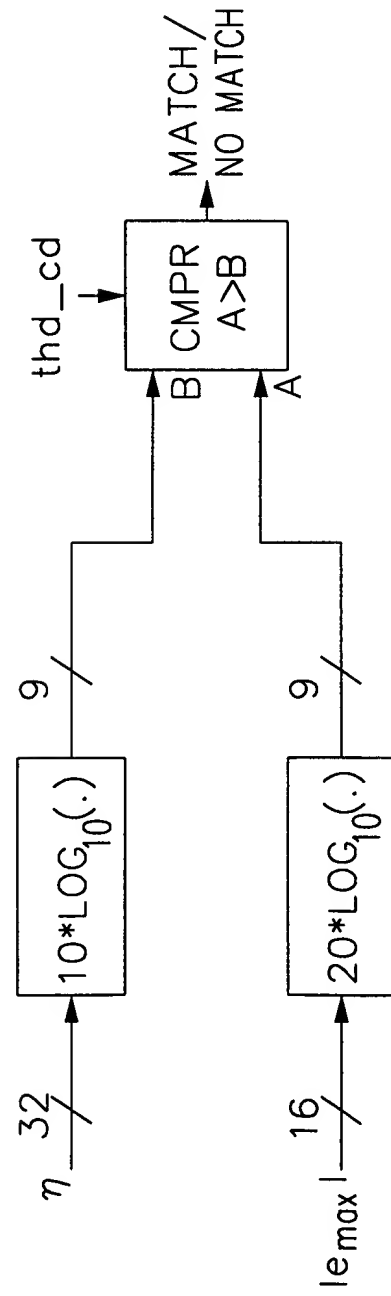


FIG.66a

TABLE INDEX	TABLE VALUE
0	0.00
1	6.00
2	12.00
3	18.00
4	24.00
5	30.00
6	36.00
7	42.25
8	48.25
9	54.25
10	60.25
11	66.25
12	72.25
13	78.25
14	84.25
15	90.25

FIG.66b

TABLE INDEX	TABLE VALUE
0	0.00
1	0.50
2	1.00
3	1.50
4	2.00
5	2.25
6	2.75
7	3.25
8	3.50
9	4.00
10	4.25
11	4.50
12	4.75
13	5.25
14	5.50
15	5.75

FIG. 67

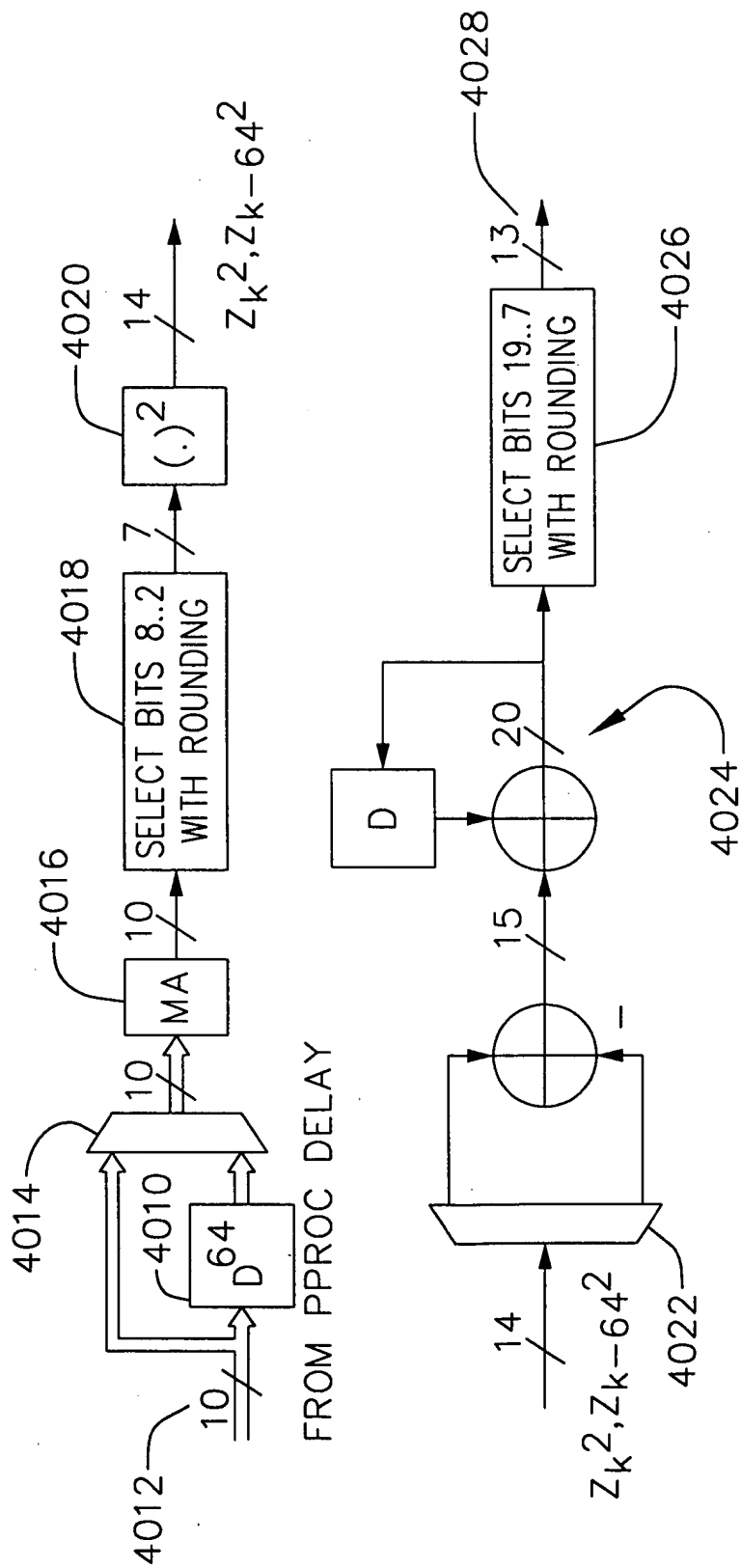
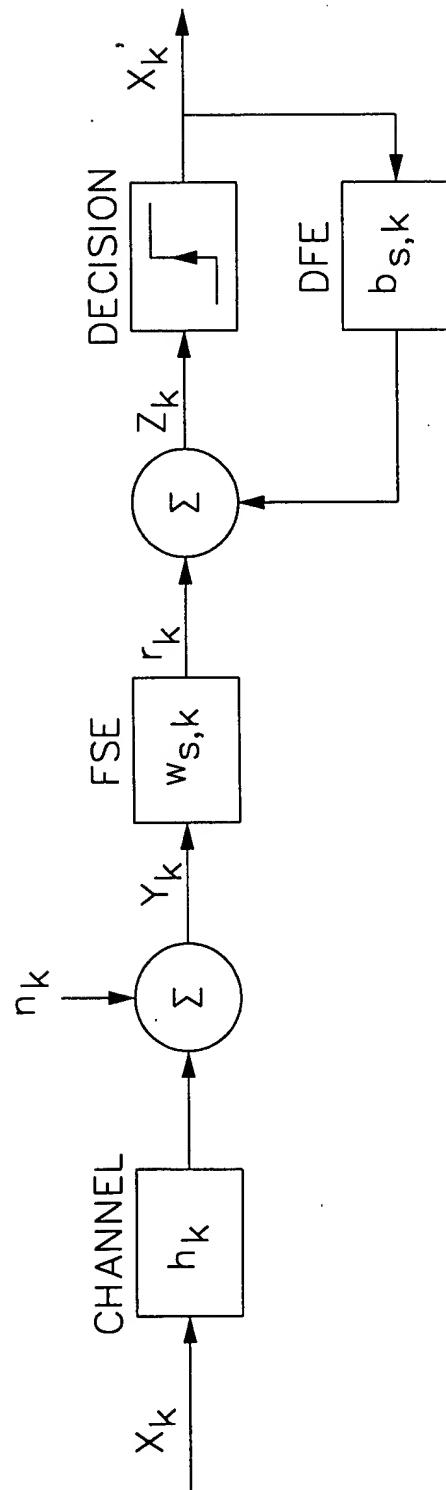


FIG. 68



09825851.040401

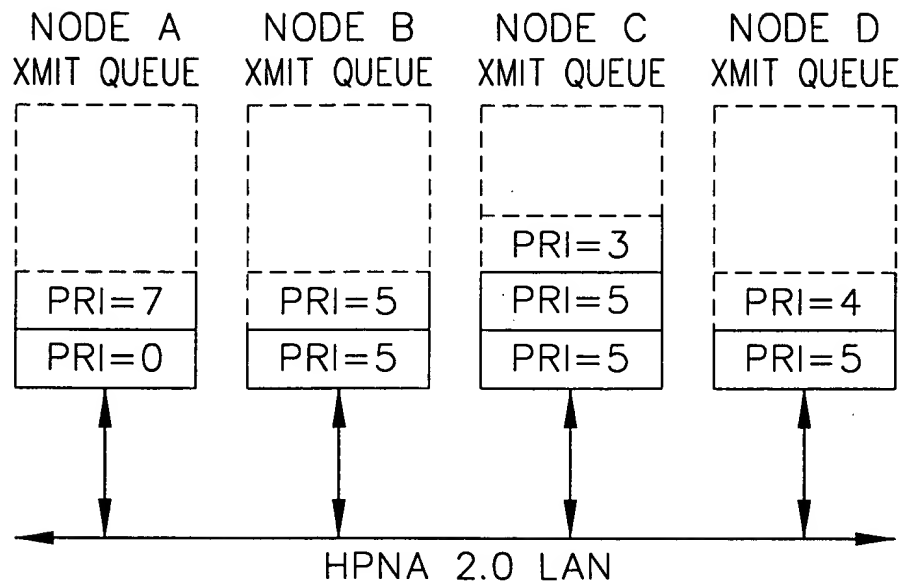
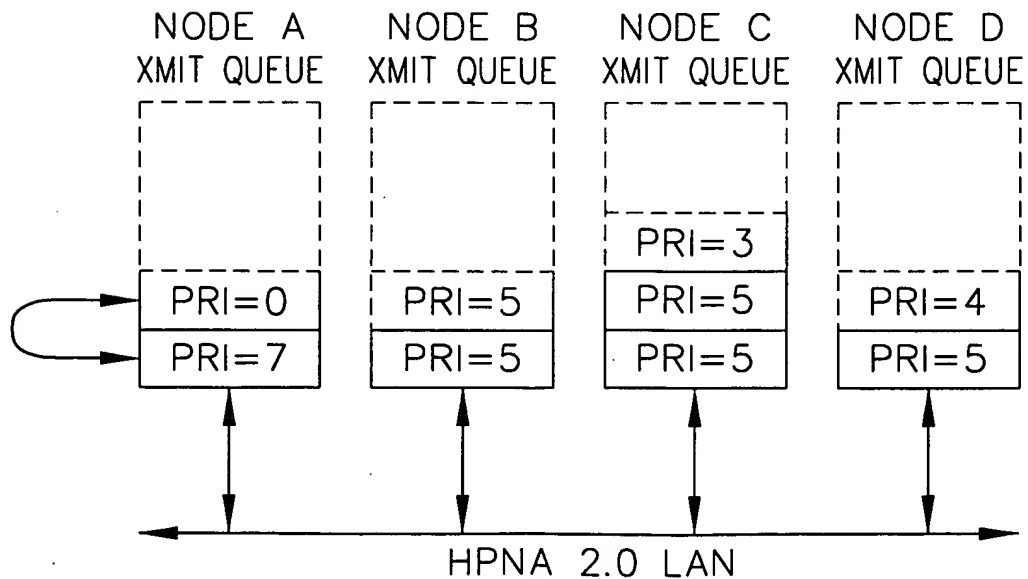
FIG. 72a*FIG. 72b*

FIG. 73

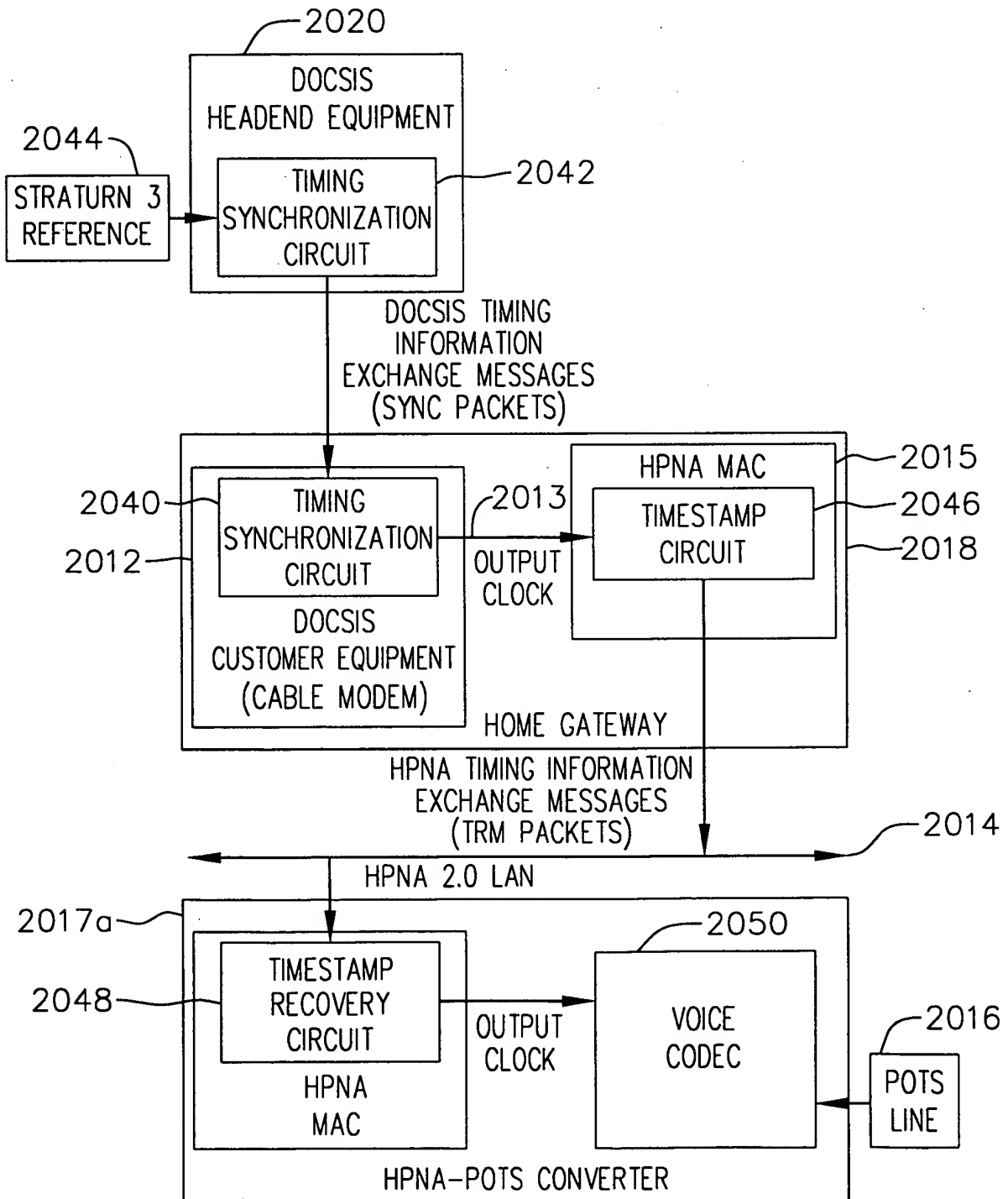


FIG.74

PARAMTER	UPSTREAM			DOWNSTREAM		
	"10E-6 CASE	91% CASE	90% CASE	"10E-6 CASE	91% CASE	90% CASE
ACCESS DELAY	3.1	1.3	1.3	3.1	1.3	1.3
COLLISION RESOLUTION	2.7	2.7	0.8	2.7	2.7	0.8
3 UP, 1 DOWN	2.1	1.0	1.0	2.1	1.0	1.0
LAST UP	0.5	0.3	0.3	0.5	0.3	0.3
COLLISION RESOLUTION	0.8	0.8	0.8	0.8	0.8	0.8
3 UP, 1 DOWN	2.1	1.0	1.0	2.1	1.0	1.0
LAST UP	0.5	0.3	0.3	0.5	0.3	0.3
3 DOWN				1.5	0.8	0.8
3 DOWN				1.5	0.8	0.8
TOTAL LATENCY	11.8	7.4	5.5	14.9	8.9	7.1

10E-6 CASE IS 10E-6 CRA ONCE OF TWO TRIES IN HOMES WITH MAXIMUM 4MBITS/SEC RAW RATE

91% CASE IS 10E-6 CRA ONCE OF TWO TRIES IN HOMES WITH MINIMUM 10MBITS/SEC RAW RATE

90% CASE IS 10E-1 CRA TWICE IN TWO TRIES IN HOMES WITH MINIMUM 10MBITS/SEC RAW RATE

VALUES IN THE TABLE ABOVE ARE IN MILLISECONDS.

OVERHEADS:

					LINEAR	5	5	5
					PCM	NODES	NODES	NODES
IFG	PER	FRAME	LARQ	RTP_H	FRAME	CRA	CRA	CRA
	COLL	HDR	HDR	DR	SIZE	10E-6	10E-1	FIXED
0.018	0.206	0.07	8	40	160	13	4	2
MSEC	MSEC	MSEC	BYTES	BYTES	BYTES	COLLISIONS	COLLISIONS	COLLISIONS

FRAME HEADER INCLUDES PREAMBLE, FC, DA, SA, T/L, EOF

FIG.75

PARAMTER	UPSTREAM			DOWNSTREAM		
	"10E-6 CASE	91% CASE	90% CASE	"10E-6 CASE	91% CASE	90% CASE
ACCESS DELAY	3.1	1.3	1.3	3.1	1.3	1.3
COLLISION RESOLUTION	0.4	0.4	0.4	0.4	0.4	0.4
3 UP, 1 DOWN	1.4	0.8	0.8	1.4	0.8	0.8
LAST UP	0.5	0.3	0.3	0.5	0.3	0.3
COLLISION RESOLUTION	0.0	0.0	0.0	0.0	0.0	0.0
3 UP, 1 DOWN	0.0	0.0	0.0	0.0	0.0	0.0
LAST UP	0.0	0.0	0.0	0.0	0.0	0.0
3 DOWN				1.1	0.6	0.6
3 DOWN				0.0	0.0	0.0
TOTAL LATENCY	5.5	2.7	2.7	6.5	3.3	3.3

Fig. 76

<u>Field</u>	<u>Length</u>	<u>Meaning</u>
DA	6 octets	Destination Address
SA	6 octets	Source Address
Ethertype	2 octets	(TBD) = VOHN Link Control Frame - new IEEE assignment
Type	2 octets	1 = Timestamp Sync Message
Length	2 octets	= 4
Version	2 octets	= 0
SeqNum	2 octets	Timestamp Sync Message Sequence Number
Pad		Any value octet
FCS	4 octets	Frame Check Sequence

Fig. 77(1)

<u>Field</u>	<u>Length</u>	<u>Meaning</u>
DA	6 octets	Destination Address
SA	6 octets	Source Address
Ethertype	2 octets	(TBD) = Vohn Link Control Frame - new IEEE assignment
Type	2 octets	2 = Timestamp Report Message
Length	2 octets	Number of additional octets in the signaling frame, starting with Version field and ending with the last octet of the Data Payload field. Minimum is 2.
Version	2 octets	= 0
TSMSeqNum	2 octets	Sequence number of TSM to which the Timestamp in this message is applicable.
Timestamp	4 octets	Timestamp of a previously transmitted Timestamp Report Message, corresponding to TSMSeqNum.
Frequency	2 octets	Resolution of the timestamp and Gtimestamp fields, in ticks/1.000ms. For example, value 32768 corresponds to one clock tick at 32.768Mhz, in which the LSBit of the Timestamp corresponds to a time of 0.030517578125usec. The Timestamp will rollover every 131 seconds = 2.2 minutes
NumGrants	2 octets	Number of Grant Timestamps specified in the payload of this control message. NumGrants may be zero. Each grant timestamp is accompanied by a Line ID and Call ID field. Including the Grant Timestamp, the total for each grant timestamp is 8 bytes.

Fig. 77(2)

Line ID	2 octet s	Identifier of the Line termination associated with the immediately following GTimestamp.
Call ID	2 octet s	Identifier of the call instance on the Line termination associated with the immediately following GTimestamp.
GrantTimestamp	4 octet s	Grant Timestamp corresponding to the immediately preceding Line ID. This is the time at which the Proxy Gateway wishes to receive a future constant bit rate service flow packet in order to minimize delivery latency to subsequent delivery to a synchronous network. The time value corresponds to the time at the timing master. Additional packets for the identified service flow are expected to arrive at periodic intervals measured from this time.
...		additional instances of {Line ID, Call ID, Grant Timestamp} field tuples
Pad		Any value octet
FCS	4 octet s	Frame Check Sequence

Fig. 78

PIN NAME	CM-side Function (HPNA timing master)		Handset Function (HPNA timing slave)	
DPLL_REF_CLK	DPLL input clock	IN		
Grant[4]	Grant Present Indication	IN		
Grant[3]	Grant SID Value[3]	IN		
Grant[2]	Grant SID Value[2]	IN		
Grant[1]	Grant SID Value[1]	IN		
Grant[0]	Grant SID Value[0]	IN		
V_CLK_OUT			DPLL output clock	OUT
GPI[0]			Grant Present Indication[0]	OUT
GPI[1]			Grant Present Indication[1]	OUT

Fig. 79

PIN NAME	CM-side Function (HPNA timing master)		Handset Function (HPNA timing slave)	
DPLL_REF_CLK	DPLL input clock	IN		
Grant[4]	Grant Present Indication	IN		
Grant[3]	Grant SID Value[3]	IN		
Grant[2]	Grant SID Value[2]	IN		
Grant[1]	Grant SID Value[1]	IN		
Grant[0]	Grant SID Value[0]	IN		
V_CLK_OUT			DPLL output clock	OUT
Frame[0]			Frame boundary marker[0]	OUT
Frame[1]			Frame boundary marker[1]	OUT

error input from software, filtered and biased
by software

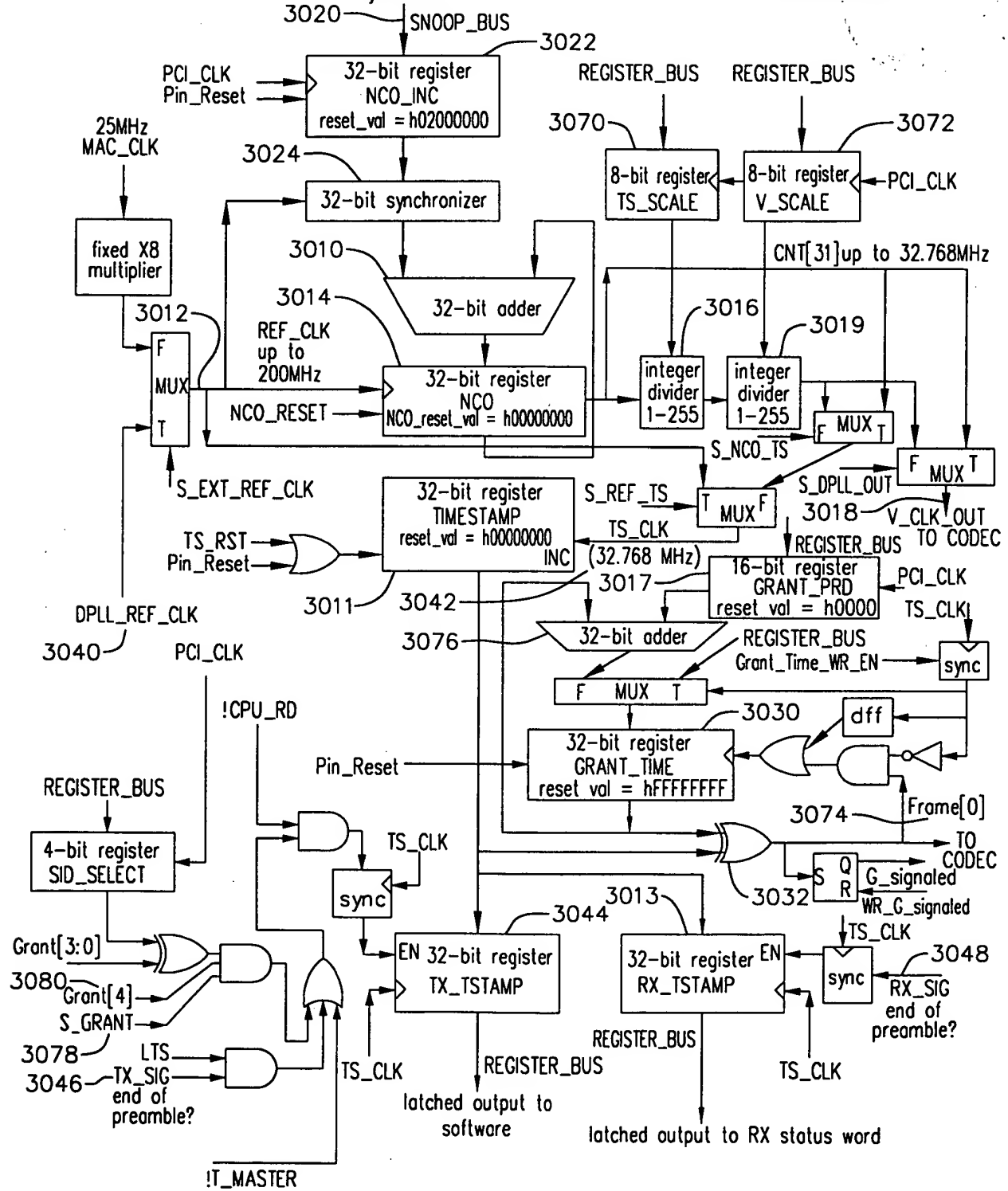


FIG. 81

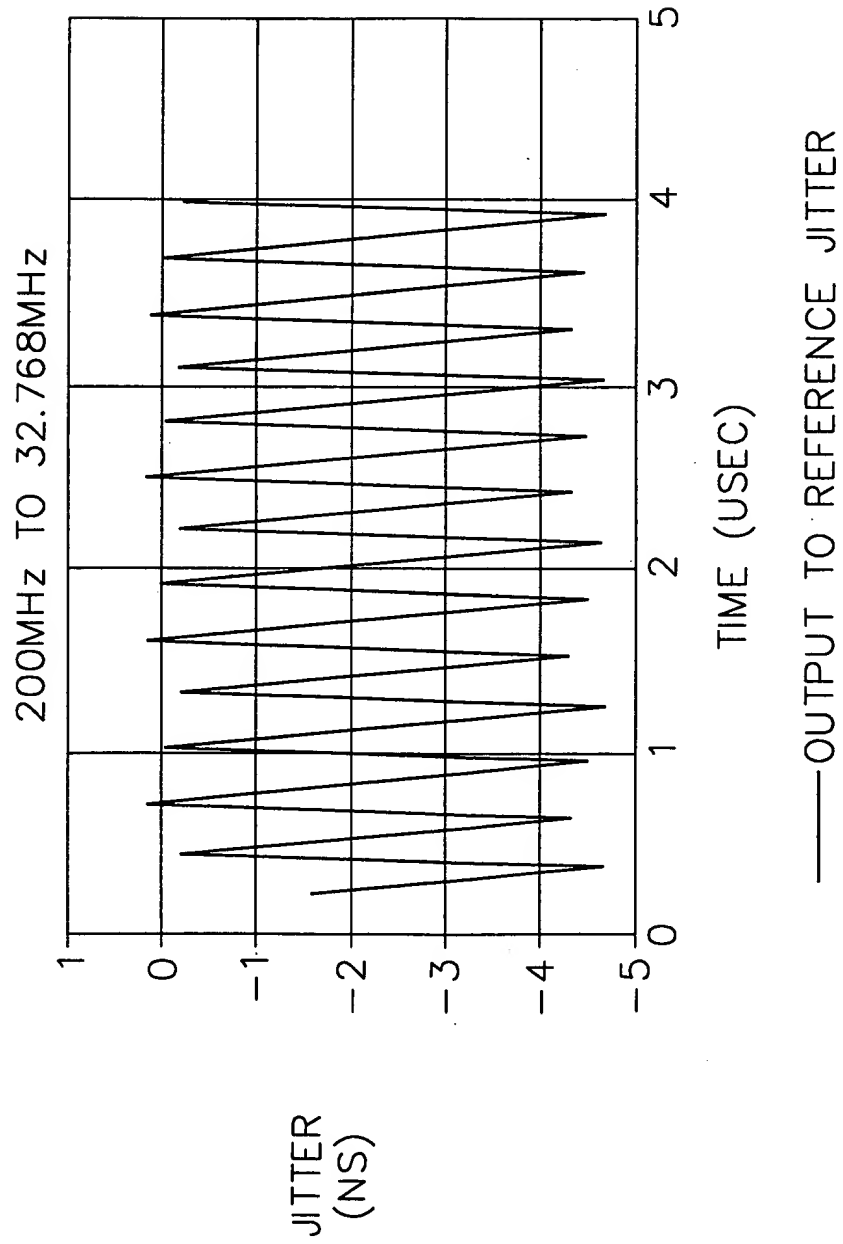


Fig. 83a

PIN NAME	CM-side Function (HPNA timing master)		Handset Function (HPNA timing slave)	
DPLL_REF_CLK	Timestamp input clock	IN	Timestamp input clock	
Grant[4]	Grant Present Indication	IN	NA	
Grant[3]	Grant SID Value[3]	IN	NA	
Grant[2]	Grant SID Value[2]	IN	NA	
Grant[1]	Grant SID Value[1]	IN	NA	
Grant[0]	Grant SID Value[0]	IN	NA	

Fig. 83b

Bit locations	Field name	Description
7-3	Reserved	
2	TsReset	When set to 1, forces timestamp register to value of 0x00000000. When set to 0, allows timestamp register to increment by one for each detected DPLL_REF_CLK rising edge.
1	SGrant	When set to 1, causes timestamp to be latched into txTimeStampHigh and txTimeStampLow registers whenever the value of tscSID matches the value of input pins Grant[3:0] and Grant[4] is asserted. When set to 0, disables txTimeStampHigh and txTimeStampLow latching under the stated conditions.
0	TMaster	When set to 1, enables txTimeStampHigh and txTimeStampLow registers to be latched with timestamp values at times determined by frame transmissions (through the LTS descriptor bit) or grant events (through the sGrant descriptor bit). When set to 0, enables txTimeStampHigh and txTimeStampLow registers to be latched with timestamp values at times determined by txTimeStampHigh and txTimeStampLow register read accesses.

Default value of this register is 0x05

Bit locations	Field name	Description
7-4	Reserved	
3-0	SID	SID value that is to be matched by Grant[3:0] pins in order to cause a grant timestamp value to be latched. When the Grant[3:0] pins match the SID value and the Grant[4] input is 1 and the sGrant register bit is 1, then the current timestamp value will be latched into the txTimeStampHigh and txTimeStampLow registers.

Default value of this register is 0x00

Fig. 83c

Fig. 83d

Bit locations	Field name	Description
15-0	txTimeStampLow	Least significant 16 bits of the latched tx timestamp value

Default value of this register is undefined.

Fig. 83e

Bit locations	Field name	Description
15-0	txTimeStampHigh	Most significant 16 bits of the latched tx timestamp value

Default value of this register is undefined.

Fig. 83f

Bit locations	Field name	Description
15-0	rxTimeStampLow	Least significant 16 bits of the latched rx timestamp value

Default value of this register is undefined.

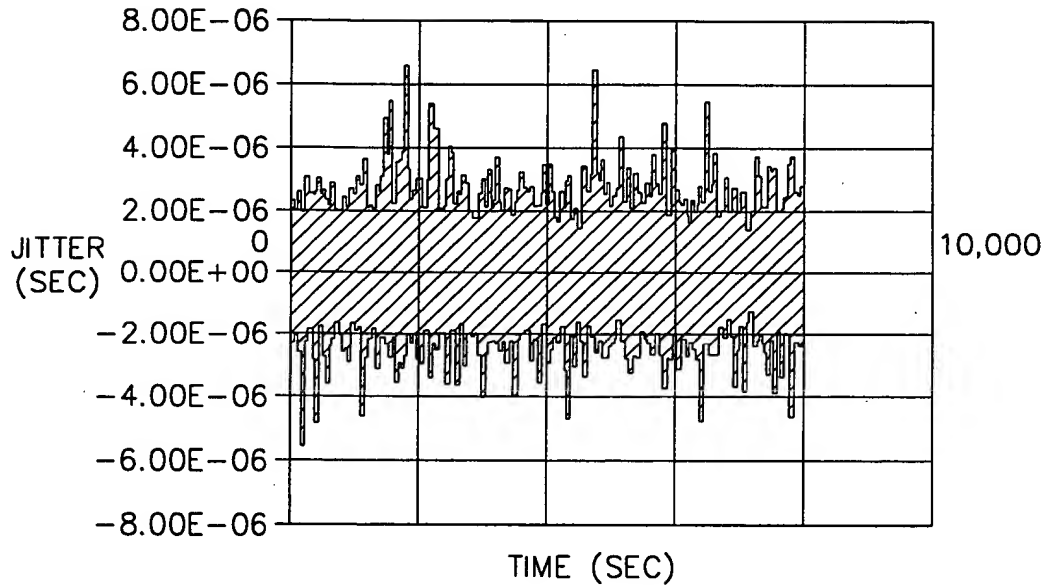
Fig. 83g

Bit locations	Field name	Description
15-0	rxTimeStampHigh	Most significant 16 bits of the latched rx timestamp value

Default value of this register is undefined.

FIG.84a

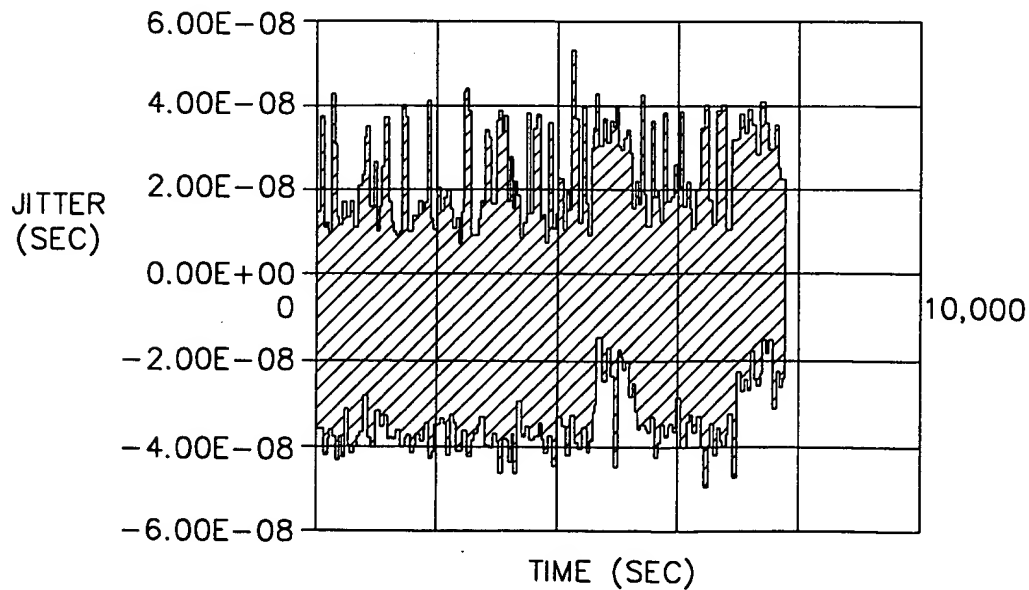
DPLL OUTPUT JITTER
TS=24.576MHz, TRM=1.0SEC, LG=0.9, IG=0.1, TGOOD=0.95,
M_J_DEV=1PPM



— DPLL OUTPUT JITTER

FIG.84b

DPLL OUTPUT JITTER
TS=24.576MHz, TRM=1.0SEC, LG=0.9, IG=0.1, TGOOD=0.95,
M_J_DEV=0PPM



— DPLL OUTPUT JITTER

Fig. 85(1)

<u>Field</u>	<u>Length</u>	<u>Meaning</u>
DA	6 octets	Destination Address (FF.FF.FF.FF.FF.FF)
SA	6 octets	Source Address
Ethertype	2 octets	0x886c (HPNA Link Control Frame)
SSType	1 octet	= TBD
SSLength	1 octet	Number of additional octets in the control header, starting with the SSVersion field and ending with the second (last) octet of the Next Ethertype field. Minimum is 16.
SSVersion	1 octet	= 0
TRM_type	1 octet	Value of x00 means that this is a TRM containing a valid timestamp. Value of x01 means that the master does not have a valid clock and slaves should give local indication that they are no longer locked to a master reference. Value of x80 means that this is a TQM. Value of x81 means that this is a TSM. All other values are reserved.
TRMSeqNum	2 octets	Timestamp Report Message Sequence Number for this message. Sequence number of x0000 indicates an initial TRM, implying that Timestamp and PrevTRMSeqNum are both invalid.
PrevTRMSeqNum	2 octets	Sequence number of TRM to which the Timestamp in this message is applicable. The value of PrevTRMSeqNum is not necessarily equal to TRMSeqNum minus one. PrevTRMSeqNum is set to x0000 for the first TRM of a TRM pair.

Fig. 85(2)

<u>Field</u>	<u>Length</u>	<u>Meaning</u>
Timestamp	4 octets	Timestamp of a previously transmitted Timestamp Report Message, corresponding to PrevTRMSeqNum. The LSBit of the Timestamp corresponds to a time of $0.030517578125\mu\text{sec}$ = one clock tick at 32.768MHz. The Timestamp will rollover every 131 seconds = 2.2 minutes.
NumSlots	1 octet	Number of Slot Timestamps specified in the payload of this control message. NumSlots may be zero. Each Slot Timestamp is accompanied by a MACAddr, and Channel_ID field. Including the Slot Timestamp, each Slot Timestamp is 12 bytes long.
PAD_0	3 octets	Padding to align to a 32-bit boundary. Always present, even when NumSlots has the value of 0.
MACAddr	6 octets	MAC Address associated with the immediately following Channel_ID and STimestamp.
Channel_ID	2 octets	Identifier for a channel associated with the immediately preceding MACAddr.
STimestamp	4 octets	Slot Timestamp corresponding to the immediately preceding Channel_ID. This is the time at which the TRM sender wishes to receive a future constant bit rate service flow packet in order to minimize overall latency of delivery to a synchronous network. The time value corresponds to the time at the timing master. Additional packets for the identified service flow are expected to arrive at periodic intervals measured from this time. The LSBit of the STimestamp corresponds to a time of $0.030517578125\mu\text{sec}$ = one clock tick at 32.768MHz.
MACAddr	6 octets	MAC Address associated with the immediately following Channel-ID and STimestamp.
Channel_ID	2 octets	Identifier for a channel associated with the immediately following Channel_ID and STimestamp.

Fig. 85(3)

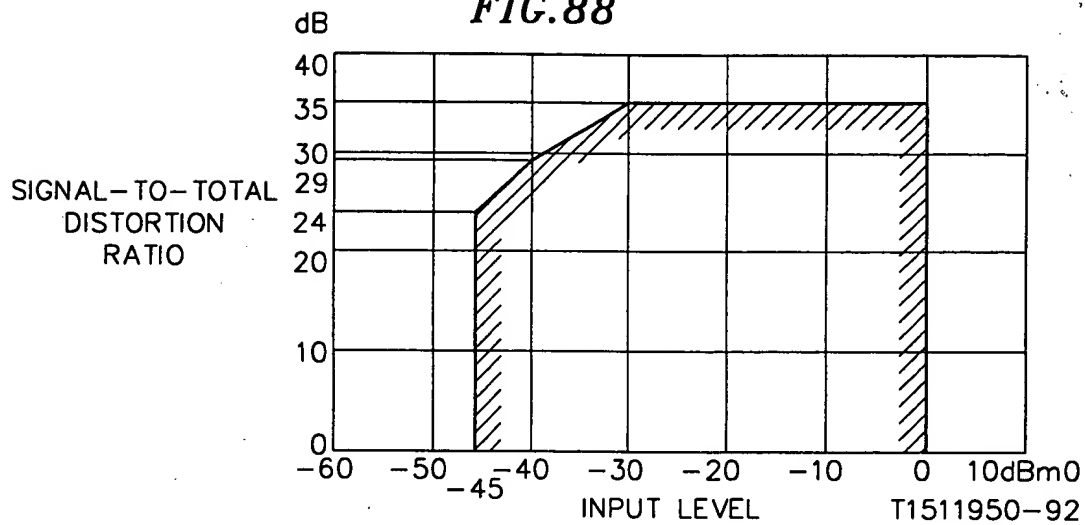
<u>Field</u>	<u>Length</u>	<u>Meaning</u>
STimestamp	4 octets	Slot Timestamp corresponding to the immediately preceding Channel_ID. This is the time at which the TRM sender wishes to receive a future constant bit rate service flow packet in order to minimize overall latency of delivery to a synchronous network. Additional packets for the identified service flow are expected to arrive at periodic intervals measured from this time. The LSBit of the STimestamp corresponds to a time of $0.030517578125\mu\text{sec}$ = one clock tick at 32.768 MHz.
...		[additional instances of MACAddr, Channel_ID and Gtimestamp fields, until the number of Gtimestamp fields equals NumGrants]
Next Ethertype	2 octets	= 0
Pad	max (0, 44 - SSLength) octets	Any value octet
FCS	4 octets	

Fig. 86

<u>Field</u>	<u>Length</u>	<u>Meaning</u>
DA	6 octets	Destination Address (FF.FF.FF.FF.FF.FF)
SA	6 octets	Source Address
Ethertype	2 octets	0x886c (HPNA Link Control Frame)
SSType	1 octet	= 6
SSLength	1 octet	Number of additional octets in the control header, starting with the SSVersion field and ending with the second (last) octet of the Next Ethertype field. Minimum is 4.
SSVersion	1 octet	= 0
TRM_type	1 octet	Value of x80 means that this is a TQM.
Next Ethertype	2 octets	= 0
Pad	MIN(0, 40-SSLength) octets	Any value octet
FCS	4 octets	

Fig. 87

<u>Field</u>	<u>Length</u>	<u>Meaning</u>
DA	6 octets	Destination Address (FF.FF.FF.FF.FF.FF)
SA	6 octets	Source Address
Ethertype	2 octets	0x886c (HPNA Link Control Frame)
SSType	1 octet	= 6
SSLength	1 octet	Number of additional octets in the control header, starting with the SSVersion field and ending with the second (last) octet of the Next Ethertype field. Minimum is 4.
SSVersion	1 octet	= 0
TRM_type	1 octet	Value of x81 means that this is a TSM.
Next Ethertype	2 octets	= 0
Pad	MIN(0, 4 - SSLength) octets	Any value octet
FCS	4 octets	

FIG.88**FIG.89a**

INPUT LEVEL	UNIFORM QUANTIZER +COMPANDER SNR	THE REQUIRED SNR FOR ADC/DAC
0dBm	38.43dB	60dB
-30dBm	35.50dB	54dB
-40dBm	30.09dB	44dB

FIG.89b

INPUT LEVEL	G.712 SNR SPEC	THE TOTAL SNR WITH UNIFORM QUANTIZER+COMPANDER+JITTER CLOCK
0dBm	35dB	38.32dB (60dB ADC/DAC SNR IS USED)
-30dBm	35dB	35.42dB (54dB ADC/DAC SNR IS USED)
-40dBm	29dB	30.05dB (44dB ADC/DAC SNR IS USED)

FIG.89c

INPUT LEVEL	G.712 SNR SPEC	THE TOTAL SNR WITH UNIFORM QUANTIZER+COMPANDER+JITTER CLOCK
0dBm	35dB	38.38dB (60dB ADC/DAC SNR IS USED)
-30dBm	35dB	35.26dB (54dB ADC/DAC SNR IS USED)
-40dBm	29dB	30.03dB (44dB ADC/DAC SNR IS USED)

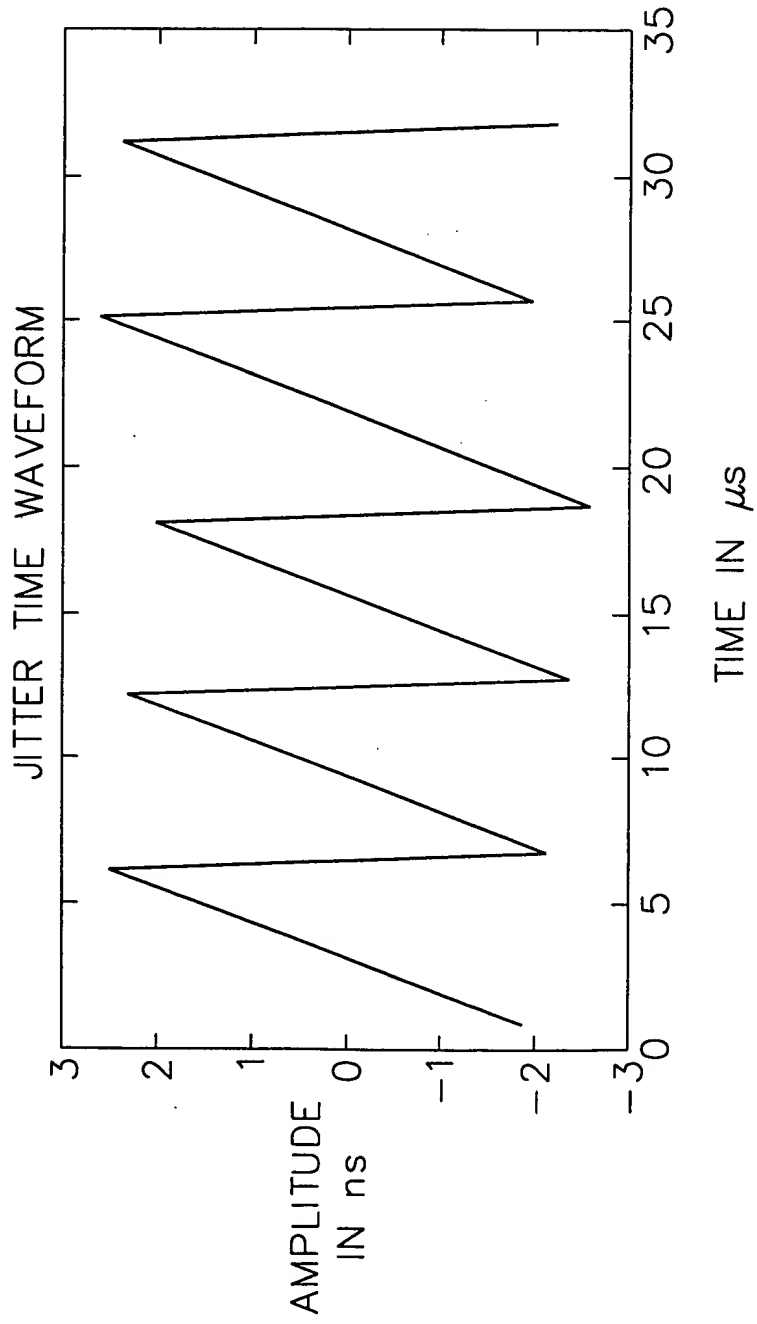


FIG. 91

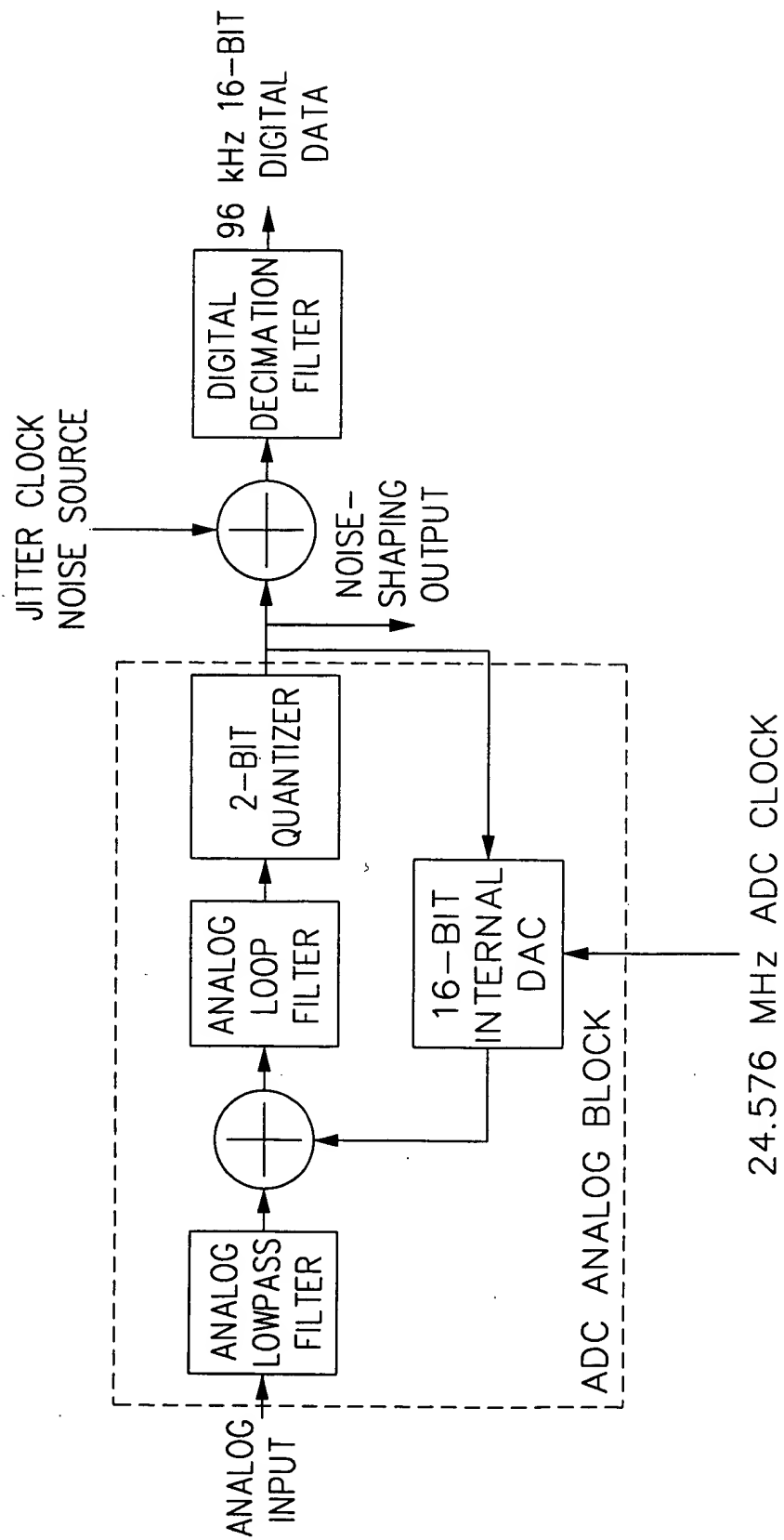
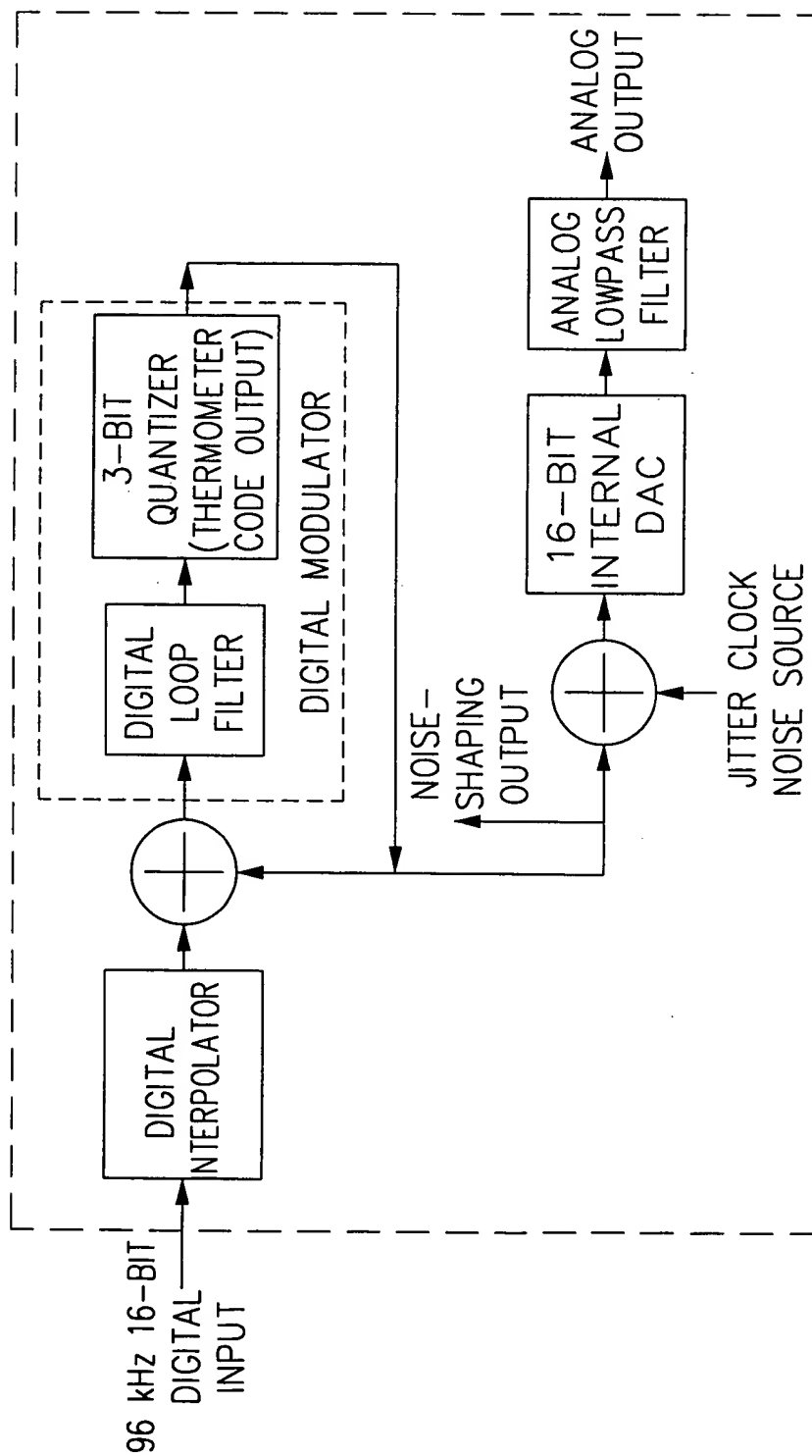


FIG. 92



24.576 MHz ADC CLOCK

Fig. 93(1)

Octet	Field	Length	Description
Flags 0	TxPriority7	1	Station is (was) transmitting frames with LL priority 7. (always set)
	TxPriority6	1	Station is (was) transmitting frames with LL priority 6.
	TxPriority5	1	Station is (was) transmitting frames with LL priority 5.
	TxPriority4	1	Station is (was) transmitting frames with LL priority 4.
	TxPriority3	1	Station is (was) transmitting frames with LL priority 3.
	TxPriority2	1	Station is (was) transmitting frames with LL priority 2.
	TxPriority1	1	Station is (was) transmitting frames with LL priority 1.
	TxPriority0	1	Station is (was) transmitting frames with LL priority 0. (always set)
Flags 1	Reserved	5	Shall be sent as 0 and ignored by 2.0 stations when received.
	CSS_Master_Capability	1	This station is capable of operating as a CSS Master node.
	No_V1M2_Frames	1	This station does not support the reception or transmission of compatibility frames (V1M2 frames).
	Supports 4Mbaud	1	This station supports 4 megabaud payload encodings.
Flags 2	Reserved	8	Shall be sent as 0 and ignored by 2.0 stations when received.
Flags 3	ConfigV2	1	Force use of 10M8 mode, defers to Config1 and ConfigV1Ms.
	ConfigV1M2	1	Force use of HPNA V1M2 mixed mode, defers to ConfigV1.

Fig. 93(2)

Octet	Field	Length	Description
	ConfigV1	1	Force use of HPNA 1.x mode, highest precedence of config flags.
	Reserved	2	Shall be sent as 0 and ignored by 2.0 stations when received.
	Highest Version	3	This station's highest supported HPNA version: 0x000 -- Reserved 0x001 -- HPNA 1.0 0x010 -- HPNA 2.0 0x001-0x111 Reserved

Fig. 9A

<u>Field</u>	<u>Length</u>	<u>Meaning</u>
CSEType	1 octet	X00 = signifies a CSS Extension type
CSELength	1 octet	X08 = Number of additional octets in this CSEType. CSELength is always x08 for CSEType = x00 = CSS
CSS_MAC	6 octets	MAC address of client station
CSS_SEQ	2 octets	<p>CSS sequence, 8 two-bit values concatenated: 0-2 indicate a specific signaling slot, while 3 indicates the use of a randomly selected value chosen by the client at the time of the collision.</p> <p>X0000 - xBFFF = assigned CSS_SEQ value for the node possessing the MAC address specified in CSS_MAC</p> <p>XC000 - xFEFF = reserved</p> <p>XFF00 = indication by the client node specified by CSS_MAC that it is no longer an active sender of link layer priority 6 frames (equivalent to a "0 active channels" indication)</p> <p>XFF01 - xFFFE = request by the client node specified by CSS_MAC for a CSS Sequence from the master node. The 8 Least significant bits indicate the number of active channels which are sending link layer.</p> <p>priority 6 frames for this client.</p> <p>XFFFF - reserved</p>

Fig. 95

2-bit CSS register value (binary)	Signal slot integer (decimal)
00	0
01	1
10	2
11	Random in range [0,2]

Bit Number	Value
7:0	Station Type: 0 – HomePNA 1.x station 1 – 10M8 station in V1M2 Mode 2 – 10M8 station in V1M2 Mode, that has detected a recent 1M8 transmission with PCOM Station Type = 0 Other values reserved
31:8	Reserved, must be 0 on transmission

Fig. 96

Precedence	Variable
1	Config V1
2	Config V1M2
3	Config V2
4	V1_DETECTED
4	V1_SINGALED

Fig. 97